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# Brazilian Economic Studies

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# Brazilian Economic Studies

N.º 1 — Edited by Wanderly J. Manso de Almeida



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# FOREWORD

This volume, the first in a new series published by IPEA through its research institute (INPES), is specially designed for foreign readers interested in the Brazilian economy. The works printed by the institute in Portuguese over the last five years already comprise nearly 60 books (mainly research reports and monographs) as well as a journal, *Pesquisa e Planejamento Econômico,* which is now in its twelfth number. The majority of these publications originated at INPES, whose work emphasizes applied research and policy-oriented studies. These publications cover the major fields of research at INPES: international trade, the public sector, industrial growth, the modernization of agriculture, the training and absorption of manpower, and urban and regional development.

While Brazil is among the developing nations on which most has been written abroad in recent years, much of the literature produced in the country remains inaccessible to the foreign reader owing to the language barrier. *Brazilian Economic Studies* is aimed at overcoming this barrier so as to render part of this literature, principally that written at IPEA, more readily accessible on the international level. The fact that the emphasis is on studies done at IPEA is clearly not meant to exclude eventual collaboration on the part of scholars belonging to other Brazilian institutions dedicated to economic study and research.

HAMILTON CARVALHO TOLOSA
Director of INPES

FERNANDO REZENDE
Deputy Director

# EDITOR'S NOTE

In selecting the articles for this collection, we were not concerned with presenting an overall view of the Brazilian economy or with describing it. Nor were we concerned with providing samples from all the fields of research explored at this institute. The articles included deal with aspects of the economy which either are or have been of major interest among our economists or in the governmental sphere: the recent recovery of the Brazilian economy, the changes in Brazilian foreign economic relations, the need to make agriculture more efficient, the importance of training the labor force, the attempt to reduce regional imbalances, and the characteristics of the accelerated urban growth.

With two exceptions, the authors are members of the research and planning staff of IPEA. All the articles are partial results of studies carried out at the institute, and some have already been published in Portuguese in *Pesquisa e Planejamento Econômico*.

The growth of the Brazilian economy in recent years is analyzed by Werner Baer, currently a member of the faculty of the University of Illinois. Professor Baer, who has cooperated with IPEA for some time, offers an interpretation of the economic recovery that the country has been experiencing since the pronounced recession of the mid-sixties. Of particular interest in his analysis are his consideration of the import substitution policy and his discussion of recent Brazilian trade strategy, with its emphasis on opening the economy to foreign markets. Also examined are the possibilities for self-sustained growth, as well as certain new problems which may have to be faced.

International economic relations also constitute the subject considered by Carlos von Doellinger. The author summarizes the results of a recent research project, presenting a detailed survey of the changes which have been made in Brazilian foreign trade policy since the mid-sixties. The efficacy of the new instruments and procedures adopted by the government is evaluated by means of an extensive comparison of import, export and capital flows.

The expansion of the agricultural product is one of the major goals of the present Brazilian government. Many allege that raising

the productivity of this sector should accelerate the migratory flows toward the urban areas, thus tending to aggravate the unemployment situation in the cities. Nonetheless, new agricultural techniques are adopted and disseminated neither easily nor rapidly. Ruy Miller Paiva, in his article on this theme, presents an analytical model which draws attention to basic questions concerning the modernization of agriculture.

Education and training are essential to promoting employment and improving the distribution of income. This widely discussed topic is a constant concern in many developing countries. In this volume, a summary of recent research on the training of manpower for industry in Brazil is presented by Claudio de Moura Castro. The author provides a detailed evaluation of the training system adopted in this country, not restricting his study to the purely economic aspects of the subject.

The qualification of labor has also proven to be highly relevant to the promotion of employment in the service sector. Although this sector is generally characterized as a perennial absorber of residual labor, its more dynamic activities are distinguished by manpower having a high degree of formal education. The implications of this with respect to promoting urban employment are explored in my study of the tertiary sector.

For the last 15 years, the Brazilian government has been striving to accelerate the industrialization of the Northeast. Underlying this federal policy is the ever-present aim to reduce regional imbalances. David E. Goodman (now at the Institute of Latin American Studies of the University of London), Júlio F. Ferreira Sena and Roberto Cavalcanti de Albuquerque seek to analyze the results of the incentive policy adopted by the Brazilian government. In their paper, emphasis is given to the effects these incentives have had on the entrepreneurial choice of techniques.

The macroeconomics of Brazilian cities is the theme of the article by Hamilton Carvalho Tolosa. This study is one of the most detailed analyses of the urban structure of the country to date. In describing and explaining the changes through which the distribution of urban sizes has passed in Brazil, the author searches for principles on which to base a national urban development policy.

With this collection, we hope to initiate an ampler exchange with all those interested in the Brazilian economy, and we extend our invitation to a candid and constructive debate.

Rio de Janeiro, August 1975

*Wanderly J. Manso de Almeida*

# THE RECENT DEVELOPMENT OF THE BRAZILIAN ECONOMY: AN INTERPRETATION *

*Werner Baer* **

## 1 — INTRODUCTION

It became fashionable during the sixties to speculate about the aftermath of Import Substitution Industrialization (ISI) in developing countries. Most analysts were pessimistic. They had doubts about the possibility of high rates of economic growth once the dynamism of ISI had vanished. Orthodox critics of the ISI process itself felt that the inefficient industrial structure resulting in the production of high-priced goods, which could not be sold in large quantities domestically or abroad, would severely limit the prospects of industrial growth. They also believed that the failure to diversify exports during the period of ISI would lead to stagnation based on import constraints. Thus, they felt that the post-ISI hopes of high rates of growth would lie primarily in developing the agricultural export sector and the rationalization of industry (i.e. weeding out industries with no present or prospective comparative advantage).[1]

Nonorthodox (sometimes called "structural") critics felt that since ISI has not solved some of the underlying socio-economic

* This paper was first published in *Pesquisa e Planejamento Econômico* 3, n.º 2 (1973): 265-302, as partial results of work done by the author at IPEA/INPES in 1973.

** I wish to thank Annibal V. Villela, Hamilton Tolosa and Renato Duarte for many valuable suggestions. The responsibility for the analysis is, of course, my own.

1 These issues are discussed in greater detail and with appropriate references to the literature in Werner Baer, "Import Substitution and Industrialization in Latin America: Experiences and Interpretations," *Latin American Research Review* 7, no. 1 (Spring 1972): 95-122.

the productivity of this sector should accelerate the migratory flows toward the urban areas, thus tending to aggravate the unemployment situation in the cities. Nonetheless, new agricultural techniques are adopted and disseminated neither easily nor rapidly. Ruy Miller Paiva, in his article on this theme, presents an analytical model which draws attention to basic questions concerning the modernization of agriculture.

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problems which were present even before the process had started – e.g. the backwardness of the agricultural sector, the unequal distribution of income, etc. – economic stagnation was bound to return once the inherent dynamism of ISI had spent itself. Some structural critics have even pointed to evidence showing that ISI has aggravated previously existing socio-economic problems. In a number of countries undergoing ISI, income has become more concentrated than before and the new industries have not created sufficient employment for the rapidly growing urban population. [2]

The post-ISI pessimism seems to have been challenged by the notable economic growth which Brazil has been experiencing since 1968. In the period 1968-1972, the country's real GDP grew at average annual rates of 10%. This situation is in stark contrast to the years of economic stagnation and drift which Brazil had experienced in the 1962-1967 period. The latter had been analyzed by economists of various persuasions as a case study of the dead-end towards which growth based solely on ISI would lead. The 1968-1972 boom is currently being studied by both defenders and critics of the Brazilian regime in order to discover whether the set of policies which are responsible for it represents a new model for post-ISI growth and development. It is my intention to present a summary of Brazil's policies which led to the boom; an examination of the sources of growth in the years since 1968 and of the socio-economic nature of this growth; and, finally, some reflections on the uniqueness of the "Brazilian Model".

## 2 – ECONOMIC POLICIES SINCE 1964

In early 1964 the Brazilian economy had already lost its dynamism. The real GDP annual growth rate had fallen from 10.3% in 1961 to 5.3%, 1.5% and 2.4% in 1962, 1963 and 1964, respectively. Inflation had gotten out of control, reaching annual rates of over 100% in mid-1964. The balance of payments showed large deficits due to both the sluggishness of exports and the low level of private and public capital inflows. Finally, the structural imbalances accentuated by the ISI industrialization – i.e. the regional imbalances, sectoral imbalances, etc. – were in part responsible for the type of socio-political unrest which made the management of the economy increasingly unwieldy.[3]

2 *Ibid.*

3 For a fuller description, see W. Baer, *Industrialization and Economic Development in Brazil* (Homewood, Illinois: Richard D. Irwin, Inc., 1965), chs. 7 and 8. Also see W. Baer and I. Kerstenetzky, "The Economy of Brazil," in *Brazil in the Sixties*, ed. Riordan Roett (Nashville, Tenn.: Vanderbilt University Press, 1972).

It was the vision of the new regime established in 1964 that the path to economic recovery lay in the control of inflation, the elimination of price distortions which had accumulated during the past, the modernization of capital markets which would lead to an increased accumulation of savings, the creation of a system of incentives which would direct investments into areas and sectors deemed essential by the government, the attraction of foreign capital (both private and official) to finance the expansion of the country's productive capacity, and the use of public investments in infrastructural projects and in certain government-owned heavy industry.

In the first years after the 1964 change of government, policy-makers emphasized stabilization and structural reforms in the financial markets. The former consisted of classic stabilization measures — curtailment of government expenditures in a number of sectors, increased tax revenues as a result of improvements in the tax-collection mechanism, tightening of credit, and a squeeze on the wage sector.[4] The stabilization program also included measures to eliminate the price distortions which had worsened during the previous decade of inflation. For example, public utility rates, which are government-controlled and which had been allowed to lag behind the rise of the general price level, were drastically raised. Although this had an additional short-run inflationary impact, sometimes called "corrective inflation",[5] it also resulted in the reduction of deficits in various sectors (e.g. transportation), thus reducing the necessity for

[4] A more detailed discussion of these policies can be found in the following articles: Mário H. Simonsen, "Brazilian Inflation: Postwar Experience and Outcome of the 1964 Reforms," in *Economic Development Issues: Latin America*, Committee for Economic Development, Supplementary Paper no. 21, August 1967; Samuel A. Morley, "Inflation and Stagnation in Brazil," *Economic Development and Cultural Change* 19, n.º 2 (January 1971):184-203; Harley H. Hinrichs and Dennis J. Mahar, "Fiscal Change as National Policy: Anatomy of a Tax Reform," in *Contemporary Brazil: Issues in Economic and Political Development*, ed. H. Jon Rosenbaum and William G. Tyler (New York: Praeger Publishers, 1972), pp. 191-208; Albert Fishlow, "Some Reflections on Post-1964 Brazilian Economic Policy," in *Authoritarian Brazil*, ed. A. Stepan (New Haven: Yale University Press, 1973); Fundação Getulio Vargas — FGV, "Políticas Econômicas: Registros de Um Quarto de Século," *Conjuntura Econômica* 26 (November 1972): 11-20; and Baer and Kerstenetzky, "The Economy of Brazil."

[5] W. Baer, I. Kerstenetzky, and M. H. Simonsen, "Transportation and Inflation: A Study of Irrational Policy-Making in Brazil," *Economic Development and Cultural Change* 13, n.º 2 (January 1965): 188-202; and Howard S. Ellis, "Corrective Inflation in Brazil, 1964-66," in *The Economy of Brazil*, ed. Howard S. Ellis (Berkeley and Los Angeles: The University of California Press, 1969), pp. 177-212.

government subsidies and contributing to the decline of government budget deficits.

The federal government budget deficit, as a proportion of GDP, steadily declined from a high of 4.2% in 1963 to 3% in 1971, while the rate of inflation was brought down to about 20%, where it hovered in the boom years 1968-1972.[6]

Throughout the sixties a series of measures were taken to modernize and strengthen Brazil's financial markets. A number of laws and regulations were instituted by the government indexing financial instruments, i. e. readjusting the value of debt instruments and the interest on them in accordance with the rate of inflation. This was applied at first to government bonds, making it possible to rely increasingly on noninflationary financing of the deficit. The principle of monetary correction was extended to other financial instruments. A bank for housing development (Banco Nacional da Habitação — BNH), which was also empowered to use readjustable debt instruments,[7] was set up. Monetary correction was applied to savings deposits, savings and loan associations and corporate debts. A mechanism was also developed to periodically revalue the capital of firms in accordance with price changes.[8]

[6] According to the FGV statistics, the rate was brought down to 14% in 1972, although there has been considerable debate over the accuracy of these data. This debate was highlighted in a critical article which appeared in one of the country's most respected newspapers: "Indices do Custo de Vida e Erros das Interpretações," *O Estado de São Paulo*, 31 January 1973. Also see José Almeida, "A Verdade sobre o Custo de Vida," *Diário da Tarde*, Ilhéus, Bahia, 30 and 31 January 1973. At the beginning of 1973 the government proclaimed its intention to bring the inflation rate down to 12%.

[7] Besides being able to tap the market by issuing indexed bonds, BNH was also able to use the resources of the employee indemnization fund (FGTS), which was created in 1966 and had begun to function officially by 1968. By the end of 1968 it had Cr$ 1.6 billion in resources. These funds grew so rapidly that by the end of 1972 they amounted to almost Cr$ 15 billion. They have by law to be deposited with BNH, and in late 1972 accounted for about 85% of the bank's resources. The FGTS funds are also subject to monetary correction. For further details see Kenneth King, "Recent Brazilian Monetary Policy" (mimeo., Belo Horizonte: CEDEPLAR, September 1972); and FGV, "Sistema Financeiro Habitacional," *Conjuntura Econômica* 26 (December 1972): 36-41, and 27 (January 1973): 37.

[8] For more thorough discussions, see: Mário H. Simonsen, "Inflation and the Money and Capital Markets of Brazil," in *The Economy of Brazil*, ed. H. S. Ellis, pp. 133-61; J. Chacel, Mário H. Simonsen, and A. Wald, *A Correção Monetária* (Rio de Janeiro: APEC Editora S. A., 1970); and Walter L. Ness, Jr., *Financial Markets Innovation as a Development*

The Capital Market Law of 1965 was designed to provide an institutional setting for strengthening and increasing the use of the stock market. (It included provisions for disclosure of financial information, protection of minority shareholders, trading regulations, etc.) It provided for the establishment of investment banks which would underwrite new issues. The law also contained fiscal incentive measures to increase the flow of funds to the stock market.[9]

Tax incentives to influence the regional and sectoral allocation of resources were widely used. Besides the previously mentioned incentive for investing in the stock market, the post-1964 governments made heavy use of the already existing tax-incentive mechanism of SUDENE (the federal development agency for the Northeast) to attract investors to that area.[10] The mechanism was also extended to the Amazon area. Other tax-incentive schemes were designed to stimulate exports, to develop tourism, to promote reforestation in accordance with a national program, etc.

It is of interest to note that government investment expenditures were never cut back in the initial years of the post-1964 governments, when stabilization was a high-priority item. Ongoing infrastructure investment projects were continued. At the same time, some basic sectoral studies were undertaken by the Brazilian government (receiving the collaboration of USAID, the World Bank and the Inter-American Development Bank — IDB) with a view towards expanding the country's power supply, transportation system, urban infrastructure, and heavy industries (especially steel, mining and petrochemicals, which were dominated by the government enterprises). There was bound to be some time lag between the feasibility studies, negotiations for financing and the actual investment activities. In fact, the impact of large new government and private investment projects began to be felt only towards the close of the sixties.

Besides the many capital market reforms already mentioned, the government, both directly and indirectly, encouraged the development of credit mechanisms designed to increase the demand

*Strategy: Initial Results from the Brazilian Experience*, Working Paper Series, no. 72-75 (New York University, Graduate School of Business Administration). In addition, see the special study of Brazil's capital markets published by FGV in *Conjuntura Econômica* 25 (April 1971): 71-154.

[9] The law allowed 10% of individual and 5% of corporate income tax liabilities to be placed in special mutual funds. These funds invested their resources in the stock market.

[10] For a more detailed analysis, see David E. Goodman, "Industrial Development in the Brazilian Northeast: An Interim Assessment of the Tax Credit Scheme of Article 34/18," in *Brazil in the Sixties*, ed. Riordan Roett, pp. 231-72.

of investors and consumers for the output of Brazil's productive capacity. For example, in the mid-sixties a number of institutions were created within the federal development bank (Banco Nacional de Desenvolvimento Econômico – BNDE) to finance the acquisition of capital goods produced within Brazil. Also, the late sixties saw the fast growth of finance companies which provided credit for the purchase of consumer goods.[11]

Foreign trade policy was also a keystone of the post-1964 governments. A drive to increase and diversify exports was considered essential to contribute to growth and to protect the economy from the effects of fluctuations in individual commodities.[12] To achieve these goals, state export taxes were abolished, administrative procedures for exports were simplified, and a number of tax incentives to increase exports were introduced. Also of importance for exports was the more realistic exchange rate policy adopted in the late sixties. It consisted of devaluing the *cruzeiro* at frequent, but unpredictable, intervals. This kept the exchange rate from becoming overvalued as inflation continued, kept speculation against the *cruzeiro* at a minimum, and, in effect, kept the exchange rate from being a political issue.

## 3 – THE GROWTH PERFORMANCE

As we already mentioned, the Brazilian economy was in a state of stagnation at the time of the 1964 change of regime. No one will ever be able to show with certainty whether the decline in the growth rate from 1962 on was due to the decline of the import substitution possibilities or to the unsettling socio-political events of the early sixties. As can be seen in Table 1a, however, the low real growth rate of the economy continued after the change of regime until 1968. Hindsight would suggest that the continued stagnation in the years 1964-1967 was due to a number of factors: the stabilization measures applied in those years; the time lag involved before the various financial and capital market reforms would be felt, and also before the various feasibility studies for the expansion of the country's infrastructure and its

11 King, p. 35.

12 Although in the 30 years prior to the mid-sixties profound structural changes had taken place in the economy due to the industrialization process, the commodity structure of exports has hardly changed. Since the import coefficient had become constant around 6% (the new import structure consisting of goods essential to Brazil's industry but not easily substitutable), and since future debt repayments depended on stable export earnings, policy-makers realized that export diversification was of vital national interest.

heavy industries would result in actual construction activities; and, finally, the time lag which was necessary to convince both the domestic and foreign (private and official) investors that the new regime and its control of the economy were stable enough for them to make substantial commitments.

It is clear from Table 1a that industry has been the leading sector in the recovery which started in 1968. The extraordinary performance of agriculture in 1971 was mainly due to the unusually high coffee production, compared to the very poor crop in the previous year.

Unfortunately, at the time this paper was written, a full set of national accounts was available only until 1969. Thus, we only have observations for the first two years of recovery. A notable feature of the growth in the years 1968 and 1969 is the constancy of the capital coefficient, i.e. gross capital formation as a

Table 1a

*Yearly Growth Rates of Real Product*

| Year | Real GDP | Per Capita Real GDP | Industrial Product | Agricultural Product |
|---|---|---|---|---|
| 1956 — 1962[a] | 7.8 | 4.0 | 10.3 | 5.7 |
| 1962 — 1967[a] | 3.7 | 1.3 | 3.9 | 4.0 |
| 1968 | 8.4 | 6.3 | 13.2 | 1.5 |
| 1969 | 9.0 | 5.9 | 10.8 | 6.0 |
| 1970 | 9.5 | 6.4 | 11.1 | 5.6 |
| 1971 | 11.3 | 7.7 | 11.2 | 12.2 |
| 1972 | 10.4 | | 13.8 | 4.1 |

Source: Calculated from Fundação Getúlio Vargas — FGV, *Conjuntura Econômica* 25 (September 1971), and 26 (February and August 1972).

[a] Yearly average.

Table 1b

*Gross Capital Formation and Taxes as Percentage of GDP*

| Year | Total Gross Capital Formation | Private Sector Investment | Government Investment | Direct Taxes | Indirect Taxes |
|---|---|---|---|---|---|
| 1956 — 1962[a] | 16.6 | 12.7 | 3.9 | 5.8 | 13.0 |
| 1962 — 1967[a] | 16.2 | 11.8 | 4.4 | 6.4 | 14.3 |
| 1968 | 16.8 | 12.6 | 4.2 | 8.7 | 17.8 |
| 1969 | 16.6 | 10.8 | 5.8 | 9.8 | 18.1 |

Source: Same as Table 1a.

[a] Yearly average.

Table 1c

*Sectoral % Composition of GDP, at Current Prices*

| Year | Agriculture | Industry | Other | Total |
|---|---|---|---|---|
| 1939 | 25.8 | 19.4 | 54.8 | 100.0 |
| 1950 | 26.7 | 23.4 | 49.9 | 100.0 |
| 1960 | 22.6 | 25.4 | 52.0 | 100.0 |
| 1965 | 22.3 | 24.4 | 53.3 | 100.0 |
| 1970 | 14.8 | 28.2 | 57.0 | 100.0 |

Source: Same as Table 1a.

percentage of GDP hardly rose from the pre-1965 years of depression to the 1968-1969 boom period. This phenomenon has been attributed to the substantial amount of excess capacity which existed throughout the sixties, thus enabling many sectors to expand output without the need for much investment expenditure. The expectation of most Brazilian economists is that the capital coefficient for the years 1970-1973 will show a marked increase for two reasons: many branches of the manufacturing sector were operating close to full capacity by the early seventies, and many firms were making new investments to increase their productive facilities; also, with the growing dominance of government investments, both in infrastructure projects and in heavy industries, which are characterized by high capital/output ratios, the overall capital coefficient is expected to show a substantial increase.

The efforts of the post-1964 governments to increase tax collection resulted in a notable increase of both direct and indirect taxes as a proportion of GDP (Table 1b). It is probable that had it not been for the above mentioned tax-incentive schemes, the direct tax/GDP ratio would have risen more.[13]

Table 1c shows that in the period 1965-1970 the decline of the share of agriculture in the GDP accelerated, while the growth of the shares of industry and services was about evenly divided. The content of the accelerated industrial growth in the late sixties and early seventies can be seen in Table 2. It will be noted that the highest growth rates occurred in capital goods, consumer durables and chemicals, while sectors producing such wage goods as textiles, clothing and food products grew at much more modest rates. It is also noteworthy that, comparing

[13] It has been estimated that by the early seventies these incentives amounted to 50% of total direct taxes.

1964 and 1970, the level of production of textiles, clothing and shoes remained stagnant, while the level of food products in 1970 exceeded the 1964 level by 42%; the range of growth between 1964 and 1970 for the more rapidly growing sectors varied from 42% in machinery output, to 66% for metal products, 69% for chemicals, 113% for electrical equipment and 144% for transport equipment.

Tables 3 and 4 offer some further physical dimensions of Brazil's growth by individual industry. It will be noted that between 1964 and 1972 installed electric power capacity, paper production, steel and cement about doubled, while motor vehicle output increased threefold (passenger cars quadrupling). Road construction activity increased dramatically in the late sixties and early seventies. The country's road network increased from a little over 36 000 km in the first half of the sixties to over 60 000 km in 1972, while the paved road network increased from about 11 000 km in 1964 to over 27 000 km in 1972.

Also, in the early seventies the country's investment in port modernization was more than twice that made in the mid-sixties.

Table 2

*Output Growth of Individual Sectors*

| Sector | Average Annual Growth Rate | | | Output Increase over Period |
|---|---|---|---|---|
| | 1967-1970 | 1971 | 1972[a] | (1970 Output) / (1964 Output) × 100 |
| *Total Manufacturing* | *14.2* | *11.6* | *14.1* | *156* |
| Nonmetallic Minerals | 17.3 | 11.1 | 12.9 | 162 |
| Metal Products | 14.4 | 5.6 | | 166 |
| Machinery | 22.7 | 3.6 | 16.2 | 142 |
| Electrical Equipment | 13.4 | 21.3 | | 213 |
| Transport Equipment | 32.6 | 19.0 | 23.7 | 244 |
| Paper and Paper Products | 9.1 | 6.3 | 6.8 | 158 |
| Rubber Products | 15.3 | 11.8 | 12.5 | 189 |
| Chemicals | 15.6 | 13.6 | 15.6 | 169 |
| Textiles | 7.4 | 8.8 | 3.6 | 96 |
| Clothing, Shoes, etc. | 1.7 | 1.8 | | 101 |
| Food Products | 8.3 | 3.6 | | 142 |
| Beverages | 8.2 | 4.8 | 15.9 | 142 |
| Tobacco | 9.6 | 5.7 | | 138 |
| *Construction* | *14.4* | *8.4* | *13.0* | *126* |
| *Public Utilities* | *12.2* | n.a. | *11.1* | *163* |

Source: Calculated from FGV, *Conjuntura Econômica* 25 (September 1971), and 26 (February and August 1972).
[a] January - November.

Table 3

*Expansion of Selected Sectors*

| Year | Installed Electric Power Capacity (mW) | Steel Production (1 000 Tons) | Cement Production (1 000 Tons) | Motor Vehicles (Units) | Passenger Cars (Units) |
|---|---|---|---|---|---|
| 1960 | 4 800 082 | 2 244 | 4 418 | 133 041 | 37 818 |
| 1964 | 6 840 000 | 3 044 | 5 529 | 183 707 | 97 768 |
| 1968 | 8 555 300 | 4 430 | 7 280 | 278 936 | 161 369 |
| 1972 | 13 089 200 | 6 501 | 10 000 | 608 985 | 408 712 |
| 1973 | 15 469 500 | | | | |

| Year | Paper (1 000 Tons) | Iron Ore (1 000 Tons) | Television (Sets) | Refrigerators (Units) |
|---|---|---|---|---|
| 1960 | 474 | 9 345 | | |
| 1964 | 650 | 16 962 | | |
| 1968 | 886 | 25 123 | | |
| 1971 | 1 237 | 31 020 | 637 899 | 520 727 |
| 1972 | | | 830 769 | 657 760 |

Source: Instituto Brasileiro de Geografia e Estatística — IBGE. *Anuário Estatístico*, various years; Estudos APEC. *A Economia Brasileira e Suas Perspectivas* (Rio de Janeiro; APEC Editora S.A., various years).

Table 4

*Road Construction: Yearly Growth Rate of Km Per Year*

| Period | New Roads | Paving |
|---|---|---|
| 1964-1967 | 12% | 6% |
| 1968-1972 | 25% | 33% |

Source: Calculated from data provided by the Ministério dos Transportes, Grupo de Estudos para Integração da Política de Transportes — GEIPOT; and FGV, *Conjuntura Econômica* 27 (February 1973).

Table 5 summarizes the foreign position of Brazil. The rapid growth of exports was more than matched by the import expansion in the 1968-1972 period. By 1971 the trade balance had become negative for the first time in over a decade. The service balance, traditionally in deficit, increased its negative position by a factor of almost three from the early sixties to the early seventies; most of the increase in the services deficit, reflecting payments for shipping, interest, dividends and royalties, occurred in the post-1968 boom period.

## Table 5

*Brazil's Foreign Economic Position (US$ Billion)*

| | 1960-1964[a] | 1965-1969[a] | 1969 | 1970 | 1971 | 1972[b] |
|---|---|---|---|---|---|---|
| Exports | 1.34 | 1.84 | 2.31 | 2.74 | 2.90 | 3.99 |
| Imports | 1.25 | 1.51 | 1.99 | 2.51 | 3.25 | 4.20 |
| Trade Balance | .910 | .330 | .318 | .232 | — .346 | — .210 |
| Service Balance | — .335 | — .508 | — .639 | — .815 | — .978 | — 1.200 |
| Net Interest and Profits | | — .224 | | — .353 | — .420 | — .480 |
| Administrative and Technical Assistance | | — .047 | | — .072 | .085 | n.a. |
| Net Foreign Direct Investment | .067 | .084 | .136 | .122 | .169 | .200 |
| Net Foreign Loans | .345 | .607 | 1.053 | 1.440 | 2.523 | 4.555 |
| Loans in Currency | | | | .680 | .908 | |
| Foreign Debt | 2.9 | | 4.4 | 5.3 | 6.6 | 10.2 |
| Reserves | | .4 | .65 | 1.187 | 1.723 | 3.9 |

Source: Banco Central do Brasil.
[a] Yearly average.
[b] Preliminary.

The current account deficit was more than offset after 1968 by the inflow of capital. The net inflow of direct investment grew from a yearly average of US$ 84 million in the period 1965-1969, to US$ 122 and 146 million in 1970 and 1971, respectively. More notable was the growth of net foreign loans, which increased from a yearly average of US$ 604 million in 1965-1969, to US$ 1 440 and 2 042 million in 1970 and 1971, respectively. The capital inflow exceeded the current account deficit to such an extent that foreign exchange reserves grew from a yearly average of US$ 400 million in 1965-1969, to US$ 1.2, 1.7 and 3.6 billion in 1970, 1971 and 1972, respectively. The foreign debt of Brazil grew steadily at the same time, reaching US$ 9 billion in late 1972.

By the early seventies substantial strides had been made in diversifying the commodity structure of Brazil's exports. The share of industrial products[14] grew from about 7% in the mid-sixties to almost 29% in 1972, while the share of iron and sugar rose to about 8% and that of meat products to 5%. Although the growth of nontraditional exports has introduced a greater measure of stability of export earnings, it cannot be considered an important explanatory factor for the economic boom. As will be noted in Table 6a, the weight of exports,

[14] The definition of "industrial products" used by the government is somewhat broad. It includes raw materials which receive some treatment prior to shipment, instant coffee, etc.

7.4% of GDP in 1970, is too small to be significant. This should be even clearer when one considers that the most dynamic exports accounted for less than one-third of the total.

Since much of the recent literature on Brazil's economic performance after the 1964 change of regime has concentrated on the trends in wages and the distribution of income, this statistical review must be completed by presenting some of the data on the matter. A subsequent section of this paper presents a short review of the discussion that this issue has generated. The preliminary 1970 census results shown in Tables 7a and 7b leave no doubt as to the increase in the concentration of the distribution of income in the sixties.[15] A number of factors have been held responsible for this phenomenon. First, as in almost all newly industrializing countries, the capital/labor ratio in industries is much higher than in the other sectors of the economy. Thus, with industry being the leading sector, increased concentration in the distribution of income is bound to occur, *caeteris paribus*. Second, since 1964 the Brazilian government, in its efforts to stabilize the economy, has adopted policies of wage restraints which for a few years, up to 1967, caused a decline of real wages and thereafter a growth of real wages lagging somewhat behind productivity growth. This is evident from the data in Table 7 on real minimum legal wages and the wage bill per worker. A third factor influencing the distribution of income has been the widespread use of tax incentives to direct resources towards specified regions and sectors of the economy. Since this affected only higher income groups, it appears that the tax system became still more regressive than it already was. Finally, some writers have also stressed the unequal distribution of training as having contributed substantially to the income distribution concentration. The high rates of growth of industry have increased the demand for scarce skilled labor supplies, thus driving up their wages relative to unskilled labor, resulting in an increased skewness of the income distribution among the wage-earning class.

[15] For more thorough discussions of measurements of Brazil's income distribution, see: Rodolf Hoffman, "Contribuição à Análise da Distribuição de Renda e da Posse da Terra no Brasil" (Livre Docência Thesis, Escola de Agricultura, Universidade de São Paulo, Piracicaba, 1971); João Carlos Duarte, "Aspectos da Distribuição de Renda no Brasil em 1970" (Piracicaba, 1971); Albert Fishlow, "Brazilian Size Distribution of Income," *American Economic Review* 62, n.º 2 (May 1972): 391-402; and Carlos G. Langoni, "Distribuição da Renda e Desenvolvimento Econômico do Brasil," *Estudos Econômicos* 2, n.º 5 (1972): 5-88.

## Table 6a

*Brazil's Export and Import Coefficients* (%)

| | 1950 | 1961 | 1964 | 1970 |
|---|---|---|---|---|
| Exports/GDP | 9.2 | 6.0 | 5.1 | 6.2 |
| Imports/GDP | 7.4 | 7.4 | 5.4 | 7.4 |

Source: Calculated from IBGE. *Anuário Estatístico*, various years.

## Table 6b

*Export Commodity Structure* (%)

| | 1965 — 1969 | 1970 | 1971 |
|---|---|---|---|
| Coffee | 42.0 | 35.8 | 23.8 |
| Other Primary Products | 50.8 | 53.0 | 57.1 |
| Iron Ore | 6.1 | 7.7 | 8.2 |
| Meat | 1.9 | 3.1 | 5.2 |
| Manufactures | 7.2 | 11.2 | 14.6 |
| Total Exports | 100.0 | 100.0 | 100.0 |

Source: Same as Table 6a.

## Table 6c

*Import Commodity Structure* (%)

| | 1965 — 1969 | 1971 |
|---|---|---|
| Raw Materials | 16.9 | 15.3 |
| Petroleum | 11.6 | 10.1 |
| Food and Beverages | 16.3 | 8.5 |
| Wheat | 9.3 | 3.3 |
| Chemicals and Pharmaceuticals | 14.9 | 15.1 |
| Capital Goods | 31.7 | 37.7 |
| Other | 20.2 | 23.4 |
| Total Imports | 100.0 | 100.0 |

Source: Same as Table 6a.

## 4 – SOURCE OF BRAZIL'S GROWTH SINCE 1968

It seems that the hight growth rates since 1958 could not have occurred without the stabilization policies, the institutional reforms and some of the government planning activities on the project level in the 1964-1967 period. Another feature was the existence of a strong and stable government which placed professional economists in key economic policy-making positions and gave them a free hand to implement their policies. This was especially important in the years when many policy measures pursued showed little results in terms of growth or elimination of the high rates of inflation. Finally, many of the factors contributing to the high rates of growth after 1968 were not present before that time:

Table 7a

*Changes in Brazilian Income Distribution, 1960-1970*

| Class | Personal Income Distribution (%) | | Per Capita Income (US$) | |
|---|---|---|---|---|
| | 1960 | 1970 | 1960 | 1970 |
| Lowest 40% | 11.2 | 9.0 | 84 | 90 |
| Next 40% | 34.3 | 27.8 | 257 | 278 |
| Next 15% | 27.0 | 27.0 | 540 | 720 |
| Top 5% | 27.4 | 36.3 | 1 645 | 2 940 |
| All Classes | 100.0 | 100.0 | 300 | 400 |

Source: Calculated from 1960 and 1970 data on income distribution.

Table 7b

*Gini Coefficients*

| Estimate | 1960 | 1970 |
|---|---|---|
| Langoni (1)[a] | .4999 | .5684 |
| Langoni (2) | .5570 | .6049 |
| Fishlow | 59 | .63 |

Source: Carlos G. Langoni. "Distribuição da Renda e Desenvolvimento Econômico do Brasil", *Estudos Econômicos* 2. n.º 5 (1972): 5-88; Albert Fishlow, "Brazilian Size Distribution of Income", *The American Economic Review* 62 (May 1972): 391-402

[a] (1) excludes persons with zero money income, whereas
(2) includes them.

Table 7c

*Minimum Legal Wages, at Constant 1953 Prices (Cr$ per Month)*

| City | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|---|---|---|---|---|---|---|---|
| Rio de Janeiro | 1.11 | 1.11 | 1.10 | 1.07 | 1.06 | 1.08 | 1.13 |
| São Paulo | 1.05 | 1.04 | 1.03 | 1.01 | 1.03 | 1.03 | 1.05 |
| Porto Alegre | 1.02 | 1.05 | 1.06 | 1.07 | 1.04 | 1.07 | 1.08 |

Source: Banco Central do Brasil, *Boletim* 8 (July 1972): 74.

Table 7d

*Wages and Value Added in Manufacturing Industries*

| Year | Annual Wage Bill per Worker (Cr$)[a] | Ratio of Wages to Value Added (%) |
|---|---|---|
| 1949 | 1 144 | 29 |
| 1955 | 1 477 | |
| 1956 | 1 590 | |
| 1957 | 1 708 | 32 |
| 1958 | 1 721 | |
| 1959 | 1 631 | 27 |
| 1962 | 1 883 | 28 |
| 1963 | 2 120 | 26 |
| 1964 | 2 052 | 25 |
| 1965 | 1 919 | 23 |
| 1966 | 2 048 | 24 |
| 1967 | 2 001 | 26 |
| 1968 | 1 873 | 25 |
| 1969 | 2 287 | 25 |
| 1970 | 2 136 | |

Source: Calculated from IBGE, *Anuário Estatístico*, various years.
[a]At 1966 constant prices.

government plans for new investment projects took a few years to evolve; in the midst of the drastic stabilization measures, government efforts to contain current expenditures outweighed new investment programs; stabilization efforts also dampened private (domestic and foreign) investment activities; and private and official international creditors were waiting to assess the stability and consistency of the regime. By 1968 these factors seemed to have been overcome.

The main source of growth since 1968 can be found in the economic activities of the government sector. Another source was the rapid expansion of the production of consumer durables. As already mentioned, the growth of exports can only be considered as a minor contributor to growth.[16]

## 4.1 — The Government Sector

One basic source for the economic growth has been the investment and production activities of the government sector. To fully appreciate this, one should consider the general role of the state in Brazil's economy.[17] This role goes substantially beyond the exercise of monetary and fiscal policies and the creation of laws and regulations affecting economic activities. It is worth mentioning, however, that even within these traditional dimensions, the Brazilian government has increased its role substantially. For instance, the ratio of government expenditures/GNP rose from 17.1% in 1947 to around 30% by the early seventies. This ratio is high by international standards, and the Brazilian government thus has considerable influence over the allocation of resources and the distribution of income as it is effected through the fiscal system. For instance, in 1969 over 36% of public expenditures went to social security programs and education, while almost 17% went for direct infrastructure expenditures (over half of this was spent on road construction).

The large fiscal presence of the public sector also implies a substantial influence over income distribution and resource allocation via taxation. The income redistributive effect of the tax system has never been very pronounced, even though direct taxes as a proportion of GDP rose from an average of 5.8% in the period 1956-1962 to 9.8% in 1969. At the same time indirect taxes as a proportion of GDP rose from 13% to 18.1%.[18] One

[16] This is not to say that exports have little relation to growth. Though they have not propelled the economy to high rates of growth since 1968, their stagnation could easily lead to a restraint on growth. The Brazilian economy's dependence on strategic imports which are key industrial inputs is such that a foreign exchange crisis due to sluggish exports and/or a drastic decline of capital inflow could slow down growth.

[17] For a more thorough review of the role of government in Brazil's economy, see Werner Baer, Isaac Kerstenetzky, and Annibal V. Villela, "The Changing Role of the State in the Brazilian Economy" (mimeo., prepared for the 20th anniversary celebration of BNDE, August 1973).

[18] These data are taken from Fernando A. Rezende da Silva, *Avaliação do Setor Público na Economia Brasileira: Estrutura Funcional da Despesa*, Relatório de Pesquisa, n.º 13 (Rio de Janeiro: IPEA/INPES, 1972), p. 22.

factor which has kept the income tax from having a pronounced redistributive effect has been the widespread use in the post-1964 period of tax incentives.[19]

Besides these traditional activities, the state has played an increasingly dominant role in banking, infrastructure and directly productive enterprises. In the banking sector the state's preponderance is considerable. The federal government has the controlling share of the Banco do Brasil, which is the country's largest commercial bank. Its deposits in 1972 were nine times as large as the largest private commercial bank. Direct government control also extends to other major financial institutions: the Banco do Nordeste do Brasil, BNDE, BNH, and the *caixas econômicas*. Government banking further extends to 15 state government commercial banks and 11 state government development banks.

Taking into account only commercial banks, government banking in 1972 accounted for 55% of deposits and 58% of loans. At the same time, over 60% of the loans of the entire financial system to the private sector came from government financial institutions.[20]

The dominance of state enterprises in steel, mining, petroleum and petrochemicals, electric energy and certain areas in transportation also contributes to making the government a much more powerful economic agent in the economy than in many other non-Socialist countries. Government enterprises are among the largest in the country. Taking the major 25 firms in terms of value of sales for 1971, it was found that eight were government firms which accounted for 31% of sales. Of the 25 largest firms in terms of employment, seven were government firms accounting for 51% of employment. Finally, of the 25 largest firms in terms of assets, 17 were government firms, accounting for 82% of total assets.[21] The great divergence between the proportion of assets and sales is mainly due to the sizeable investment in power-generating facilities, steel, petrochemicals and mining. As will be seen shortly, capacity increased substantially in some of these industries during the late sixties and early seventies. Thus, the large proportion of government firms in value of total assets reflects a tremendous growth of sales potential.[22]

19 See fn. 13.

20 Calculated from Banco Central do Brasil, *Boletim* 9, no. 3 (March 1973): 41-96.

21 Calculated from "Quem É Quem na Economia Brasileira," *Visão* 41 (August 1972): 172-93.

22 Taking a large number of firms, i.e. the 100 largest, it was found that government firms accounted for over 68% of total assets.

Data for individual sectors are also revealing. In power generation, government firms became dominant in the sixties. In 1962 they accounted for 36% of the country's electric power generating capacity, while by 1971 this position had risen to 80%. In 1971 government firms accounted for about 56% of sales and over 72% of the value of total assets in the steel industry. Almost 80% of Brazil's iron ore was exported by a government firm, Cia. Vale do Rio Doce. Petrobrás, Brazil's largest firm, accounted for 41% of the value of sales and for 81% of the value of assets in the petroleum and petrochemical sector in 1971. The state also has a quasi-monopoly in railroad transportation and telecommunications and controls almost 70% of Brazilian shipping, and individual states own large companies providing various types of public services.

The founding in 1968 of a price policy commission (Conselho Interministerial de Preços – CIP) marked a new chapter in state control not only over prices but also over general resource allocation. Its directors are the Ministers of Finance, Planning, Commerce and Agriculture. It cannot set prices legally, but acts as a general watching commission over prices. Its indirect powers are substantial. For example, if a firm raises prices without submitting a justification to CIP, and/or if the justification is submitted but not accepted by CIP and prices are raised anyway, the firm risks having its credit line eliminated with the Banco do Brasil and all other government banks, and much of its general credit worthiness with the private banking sector will have been diminished since the Central Bank can refuse to rediscount the firm's credit instruments. Thus almost all firms of sectors in which CIP has an interest must obtain permission for price increases and must justify their requests by providing cost information. With a few exceptions, CIP has avoided creating price distortions in industry by taking into account cost information and setting prices with regard to reasonable rates of profit. In the process, however, the government has gained an unusual amount of information on the activities of the private sector and thus increased its control thereof.

Such government influence over the country's economy provides an explanation for the high rates of growth since 1968. Glancing back at Table 1b, it will be noted that government investment as a proportion of GDP kept rising during the stagnation years of the mid-sixties, while private investment declined throughout the sixties. Considering that government enterprises are included in the "private" sector in Brazil's national income accounting system, and that investment activities of government firms, especially in the power-generating

industry,[23] continued even through the stabilization years in the mid-sixties, one would be on fairly solid ground in assuming that real private investment activities declined even more than indicated in Table 1b. Incidentally, it seems that much of the fiscal part of the stabilization program consisted in a relative decrease in current government expenditures, whose proportion of GDP fell from 13.1% in the years 1961-1964, to 11.6% in 1968-1969.

As was mentioned previously, throughout the sixties and into the first years of the seventies, the government undertook various feasibility studies in preparation for a vast expansion program in infrastructure and heavy industries under its control. Taking into account the time such studies took and the loan negotiations to finance recommended projects, one more readily understands why government investment programs only began to have a major impact on the Brazilian economy in the late sixties.

Although data to back these claims were scarce at this writing, Tables 8 through 10 provide at least some partial evidence. In Table 8a are listed the number of feasibility studies in transportation which were conducted throughout the period under analysis. Also presented are the transportation loans made by the World Bank and IDB. These loans grew towards the end of the sixties and reflected the substantial increase in the rate of growth of road construction activity, which was already noted in Table 4. Table 8b reveals a steady inflow of loans for expanding the country's power-generation facilities throughout the sixties. This is also clear from Table 9, which shows high rates of growth of investment in that sector both in the mid-sixties and in the seventies. Clearly, investment in power-generating facilities in the mid-sixties confirms the above mentioned impression of continued government investment activities even during the stagnation of the mid-sixties. On the other hand, as can also be noted in Table 9, investment in the Petrobrás enterprises showed a vigorous recovery only at the end of the sixties.

In Table 10 another estimate is attempted in quantifying investment activities of government firms, and comparing them to those of the private sector. The growth of the value of fixed assets of government and private firms, corrected for price changes, was calculated from balance sheet data. These data should, of course, be used only as indicators of the growth of productive capacity. Negative values do not necessarily mean decline in productive capacity, but these are usually due to adjustments

[23] It will be noted in Table 9 that the rate of growth of investments in power generation reached very high levels in the mid-sixties.

in the valuation of capital at a slower rate than the wholesale price increase for industrial products. Negative or low positive growth rates indicate the probability of a small increase, or none, in productive capacity. The evidence suggests that since 1968 the rate of growth of investments made by the government directly and by government firms has led that of most other sectors. It is even possible that these figures are underestimates for government firms. For instance, Table 9 shows exceptionally large increases in Petrobrás investment activities after 1969, while the growth of the value of fixed assets in the years 1967-1971, as shown in Table 10b, was only 7.5% per year. In all probability one can assume a lag in the incorporation of new capacity under construction into the balance sheets of firms.

From the evidence avilable, one can reach the following tentative conclusions: throughout the sixties, and at an accelerated rate in the late sixties and early seventies, there was a vast expansion of government power-generating firms. During the mid-sixties the government was engaged in feasibility studies for expanding and modernizing the transportation network, and by the late sixties vast investment programs were started which contributed to the boom period. Modernization and investment expenditures also began in the late sixties in such government-dominated sectors as petrochemicals and mining. Studies of and debate over the expansion of the steel industry lasted a little longer than in some of the other government-dominated sectors, and it was only in the early seventies that large loans from international institutions for steel expansion were made.[24] This explains the low rate of growth of steel capacity expansion in Table 10b. Finally, the contribution of housing construction financed through the government BNH was another contributory factor to the rapid growth trend. Unfortunately no systematic data on housing construction are published. The indirect evidence we have is the enormous growth of BNH financing, which grew from Cr$ 89 million in 1966 to about Cr$ 14 000 million in 1972. In sum, there seems little doubt that a combination of the direct government infrastructure investment programs and the expansion of government firms, which are the largest in the country, made the public sector the pace-setter for Brazil's expansion after 1968.

24 The first large World Bank loan for steel expansion was made in 1971-1972, amounting to US$ 192 million, while the Inter-American Development Bank lent US$ 128 million for the expansion of the three large government steel firms.

## 4.2 — Consumer Durable Sector

The second source of growth in the post-1968 period was the expansion of consumer durable production. In fact, glancing back at Table 2, it will be noted that the rate of growth of the transport equipment sector was ahead of all other manufacturing sectors. The rapid growth of consumer durable production is also recorded in absolute terms for some individual products in Table 3. Finally, the output expansion in this sector can be summarized with index numbers for the automobile, electric and electronic home appliances (1964 = 100):[25]

| | 1964 | 1968 | 1972 (Oct.) |
|---|---|---|---|
| Automobile Production | 100 | 149 | 360 |
| Electric Home Appliances | 100 | 137 | 314 |
| Eletronic Home Appliances | 100 | 185 | 399 |

Despite the high growth rates of consumer durables, it would be erroneous to assign them a role equivalent to that of the government sector in the post-1968 boom. As will be noted in Table 11, the share of transport and electrical equipment in total value added of the manufacturing sector amounted to only

Table 8a

*Transportation and Communication: Projects and Loans*

| Feasibility Studies | | Loans (US$ Million) | | | |
|---|---|---|---|---|---|
| Period | N.° of Projects | Year | IDB | Period | World Bank |
| 1964-1965 | 8 | 1966 | 25.6 | | |
| 1967-1968 | 4 | 1968 | 25.0 | | |
| 1968-1969 | 6 | | | 1968-1969 | 28.0 |
| 1969-1970 | 40 | | | | |
| | | 1970 | 35.7 | | |
| 1970-1971 | 40 | 1971 | 47.3 | 1970-1971 | 45.0 |
| 1971-1972 | 65 | 1972 | 40.0 | 1971-1972 | 192.0 |

Source: Partial information received from the Departamento Nacional de Estradas de Rodagem of the Ministério dos Transportes, the Ministério do Planejamento and the Agency for International Development.

25 From Banco Central do Brasil, *Boletim* 8 (February 1973): 134.

Table 8b

*Electric Energy: Loans*

| World Bank | | AID | | IDB | |
|---|---|---|---|---|---|
| Period | US$ Million | Year | US$ Million | Year | US$ Million |
| | | | | 1962 | 20.2 |
| | | 1963 | 22.7 | 1963 | 13.3 |
| 1964-1965 | 79.5 | 1964 | 48.4 | 1964 | 2.4 |
| | | 1965 | 70.1 | 1965 | 25.5 |
| 1966-1967 | 100.6 | 1966 | 21.0 | 1966 | 30.0 |
| | | 1967 | 41.2 | 1967 | 34.1 |
| 1969-1970 | 80.0 | 1969 | 27.4 | 1969 | 56.4 |
| 1970-1971 | 70.0 | | | 1970 | 30.8 |
| 1971-1972 | 60.0 | 1971 | 2.5 | 1971 | 70.1 |
| | | | | 1972 | 57.2 |

Source: Same as Table 8a.

Table 9

*Rate of Growth of Investment Activities of Government Enterprises*

| Period | Power Generation, Transmission and Distribution | Petrobrás Investment in Fixed Capital | Investment in City Gas Production |
|---|---|---|---|
| 1964-1965 | n.a. | 2.8 | — 25.7 |
| 1965-1966 | n.a. | — 21.5 | — 24.3 |
| 1966-1967 | 26.1 | — 14.8 | 188.5 |
| 1967-1968 | 15.1 | — 14.8 | 83.8 |
| 1968-1969 | 5.2 | 31.4 | — 24.2 |
| 1969-1970 | 9.1 | 155.0 | 38.2 |
| 1970-1971 | 26.1 | 123.5 | 122.8 |

Source: Calculated from Luiz Octávio Souza e Silva *et al.*, "Panorama Global da Energia no Brasil. 1964-1971" (mimeo., Rio de Janeiro: IPEA/INPES, 1972), pp. 45-46.

14.8% in 1969. However, the share of manufacturing sectors directly dominated by government firms or affected by the government investment activities (nonmetallic minerals, metal products, machinery and chemicals) was 33.5%. It would thus seem in order to assign to the growth consumer durable goods production a role secondary to that of government in the post-1968 period.

## Table 10a

*Rate of Growth of Productive Capacity of Government and Private Enterprise*

Rate of Growth of Fixed Assets — Unadjusted

| | 1967-1968 | 1968-1969 | 1969-1970 | 1970-1971 |
|---|---|---|---|---|
| Fixed Assets of 31 Government Firms | 10.7 | 30.2 | 23.4 | 23.1 |
| Total Fixed Capital Formation: | 23.5 | 9.7 | n.a. | n.a. |
| Government | — 1.5 | 50.8 | n.a. | n.a. |
| Enterprises | 34.8 | — 3.8 | n.a. | n.a. |

Source: See Table 10b.

## Table 10b

*Annual Rate of Growth of Adjusted Fixed Assets of the 10 Largest Government Firms and Selected Private Enterprises, 1967-1971*

| Government Firms | | Private Firms | |
|---|---|---|---|
| Petrobrás | 7.5 | Light S.A. | 19.7 |
| CESP | 28.8 | Volkswagen | 49.3 |
| Eletrobrás | 54.3 | General Motors | 18.6 |
| CEMIG | 31.1 | Ford | 41.1 |
| CHESF | 37.1 | Cia. Belgo Mineira | 1.4 |
| COSIPA | 4.1 | General Electric | — .4 |
| CSN | 21.4 | Klabin Cel. | 12.1 |
| USIMINAS | 3.3 | Ind. Villares | 21.7 |
| Furnas | 19.2 | Itaú | 12.5 |
| Cia. Vale do Rio Doce | 21.9 | S.A. White Martins | 10.2 |
| | | Votorantim | 46.4 |
| | | Brahma | 14.6 |
| Average | 24.4 | Nova América | 14.3 |
| | | Cobrasma | — 12.9 |
| | | Rhodia | 52.3 |

Source: Calculated from balance sheet data published yearly since 1968 by the magazine *Visão* in its October special issue entiled "Quem é Quem na Economia Brasileira". To determine the change in the real value of fixed assets, the data were adjusted by the FGV wholesale price index for industrial products (1965-1967 = 100). Data for 31 government enterprises in Table 10a were not adjusted for changes in the value of assets due to inflation; these changes are included in the value fixed assets for each year. In Table 10b these adjustments were made for all government firms and all private firms except the starred companies. Adjusted data were kindly furnished by Luiz Guilherme Correa Hettenhausen of the Centro de Estudos Fiscais, FGV. Rate of growth of total fixed capital formation and real GDP are taken from *Conjuntura Economica*.

Table 11

*Sectoral Distribution of Value Added in Manufacturing, 1969*

| Sector | % | Sector | % |
|---|---|---|---|
| Nonmetallic Minerals | 5.8 | Pharmaceuticals | 3.9 |
| Metal Products | 11.4 | Cosmetics | 1.6 |
| Machinery | 6.0 | Plastics | 1.8 |
| Electrical Equipment | 6.2 | Textiles | 10.1 |
| Transport Equipment | 8.6 | Clothing and Shoes | 2.8 |
| Wood Products | 2.6 | Food Products | 12.9 |
| Furniture | 1.6 | Beverages | 2.7 |
| Paper Products | 2.6 | Tobacco | 1.5 |
| Rubber and Products | 2.6 | Printing and Publishing | 3.0 |
| Leather Products | .6 | Miscellaneous | 1.9 |
| Chemicals | 10.3 | | |
| | | Total | 100.0 |

Source: Calculated from IBGE. *Produção Industrial*. 1969.

The source of demand for these goods can be found both in the high rate of growth of the income of upper-income groups (not only property owners, but also the small skilled labor force), especially in the late sixties, and in the rapid growth of consumer credit, which was made possible by the various reforms in the country's financial markets. Finance companies, which accounted for most of the consumer credit, experienced large expansion in the late sixties. In 1966 their loans amounted to about 8% of the financial system and by 1972 they had grown to almost 13%.

Available evidence suggests that the high rate of output in this sector was at first based on the substantial amount of excess capacity which existed in the mid-sixties. For example, in 1965 the consumer durable goods industry was operating with about 40% of excess capacity.[20] Thus, production for at least the first two years of the boom was based on the greater utilization of existing capacity. Indirect evidence for this can be found in Table 5 by examining the net inflow of foreign direct investment, since many firms in the consumer durable sector are owned by foreign companies and substantial expansion of facilities would be associated with increased capital inflows. It will be noted that the yearly rate of capital inflow did not rise until 1969. The average

[20] Werner Baer and Andrea Maneschi, "Import-Substitution, Stagnation, and Structural Change: An Interpretation of the Brazilian Case," *The Journal of Developing Areas* 5 (January 1971): 180.

yearly rate of inflow in the period 1965-1969 was 84 million dollars. In 1968 only 63 million dollars of direct investment capital entered Brazil. This more than doubled in the following year and remained at high levels thereafter. It would thus be safe to assume that in 1968 and 1969 capacity was expanded only slightly (assuming it takes some time for the capital inflow to be translated into investment activities). From 1970 on, however, both continued production increases and capacity expansion in the consumer durable sector gave impetus to the economy.

## 4.3 — Other Sources of Growth

It is our impression that the government and consumer durable sectors provide the principal explanation for the high growth rates since 1968. Other sources of growth are relatively minor in their impact and rather complementary in nature. The already mentioned tax incentives used to stimulate investment in certain geographical areas (SUDENE Article 34/18 being the best known) and certain favored sectors (such as tourism and exports) no doubt also contributed to the national growth rate. However, as we already mentioned for the case of exports, the relative impact of these sectors was slight in comparison to government investment programs and consumer durable (especially automobile) production.

# 5 — EVALUATION

Since it will take a few years (until more information is available) to be able to provide more definitive analyses and interpretations of the boom which started in 1968, we shall end our paper by raising some questions which might contribute to a research agenda on the recent Brazilian experience and provide some food for thought which might lead us to reexamine the paradigms within which many of us operate. It is our impression that the contributors to the literature on the recent Brazilian development can be divided into two groups: those who view the country's high growth rates since 1968 as a natural outcome of the rationalization of economic activity through the building of a modern capital market and financial instruments,[27] and those who concentrate on the sacrifices made by the lower-income groups and on the

[27] See, for example, Mário H. Simonsen, *Brasil 2002* (Rio de Janeiro: APEC Editora S.A., 1972), chs. 2 and 3.

long-term viability of such systems.[28] It is possible that although both groups have made contributions in drawing attention to important aspects of the recent growth experience, they each presented a partial picture and thus prevented us from gaining a full understanding of the post-1968 trend. This becomes evident when one considers that the role of the state, which was discussed above at length, was almost entirely neglected in the literature.

*a. What Is the Essence of the Brazilian Model?* The uniqueness of the Brazilian experience since 1964 lies in the free manipulation by technicians, backed by a strong government, of an economic system which is dominated by the state, but which allows for a sizeable private sector. This manipulation was possible because of the existence of strong and stable governments which ensured that economic policies were fully carried out, regardless of side-effects they would have on various economic groups. If we add to this the large geographical, population and natural resource base of the country, it is hard to see why high growth rates were not achieved.

*b. How Adequate Is the Content of Brazil's Growth?* Many analysts of the Brazilian experience are uneasy about the content of the growth which has taken place. They argue about the advisability of producing many luxury consumer durable goods in a society whose per capita income was still below US$ 500.

Even if one accepts this critique, it would not be a condemnation of the entire recent Brazilian growth experience. As we have seen in this paper, much of this growth was due to the expansion of the country's electric-power capacity, road network, urban rapid-transit systems, basic industries, housing, etc., which provide the base on which to build a growing industrial society. One assumes that this aspect of the country's growth content would be fairly exempt from criticism, unless one places no premium on current savings for future consumption.

It is more difficult to defend consumer durable goods. To the the assertion that their production creates employment, one could easily anwer that goods for the masses can be produced in a

[28] Maria da Conceição Tavares, *Da Substituição de Importações ao Capitalismo Financeiro* (Rio de Janeiro: Zahar Editores, 1972); Edmar L. Bacha, "Sobre a Dinâmica de Crescimento da Economia Industrial Subdesenvolvida" (mimeo., Universidade de Brasília, Departamento de Economia, 1973); Celso Furtado, *Análise do "Modelo" Brasileiro* (Rio de Janeiro: Civilização Brasileira, 1972); and Paul I. Singer, *O "Milagre Brasileiro": Causas e Conseqüências* (São Paulo: Cadernos CEBRAP, 1972).

more labor-intensive way. However, a defense which some might call "mephistophelean", could be made on the grounds of technological progress. The production of automobiles, household appliances, etc., requires the development of the type of sophisticated industrial organization and skilled labor force which might hasten the day in which the country will become less technologically dependent.

*c. Does the Concentration of Income of the Last Decade Imply a Permanent Dualism in Brazil's Economic Income Structure?* It has been the contention of a number of writers (including the present one) that the concentration in the distribution of income will ultimately lead to stagnation since the small proportion of the population in the upper parts of the distribution will not constitute a market large enough to sustain economic growth. It would seem that this argument does not apply to Brazil for two reasons. First, there is the size of the government sector which, if correctely manipulated, can keep growth going. Second, there is the size of Brazil's population. Even if 20% of the population receives 60% of the country's income, this represents 20 million people, which is a large market.

It has thus been suggested that a new dualism is developing in Brazil, in which two socio-economic groups will live side-by-side and perpetuate themselves. This was coined as the "Belgium in India" situation, i.e., a population of 20 million with a per capita income of over US$ 800 (and the 5 million in the upper 5 percent with incomes of US$ 3 000), while 80 million receive income below US$ 300. Is this a permanent dualism? Or, assuming no drastic income redistribution policies by decree, would the dynamism inherent in a market serving 20 million people gradually draw an increasingly larger number of the 80 million into the higher income society? Some have claimed that the need for skilled labor in the modern sector of the economy and the increasing educational expenditures of the government will bring this about.[20] In other words, the continued dynamism of the 20 million population universe and increased educational expenditures will ultimately break this dualism down. This position has not, however, been unanimously accepted by the profession. There are some economists who have even argued and tried to present some evidence showing that "... social background is considerably more important as a determinant of both educational attainment and economic success than has been indicated in

[20] Langoni, pp. 81-88.

recent analogous statistical treatments. . . ." [30] Only further research will throw more light on these arguments.

*d. The Indexed Credit Puzzle.* Although the indexed credit instruments developed in the sixties were the basis for the rapid expansion of housing construction and the buying of consumer durables, serious problems seem to have developed in debt repayments, especially in the housing sector. Either due to income growth of the debtors lagging behind debt readjustments, or due to lack of family expenditure planning (which would take into account increases in the money debt), a serious arrear in payments developed in the early seventies. This places the policy-makers in a difficult position. Either the indexing mechanism will remain unaltered and debt default will cause housing evictions, or income will have to be redistributed through an indexing mechanism which lags behind price increases. A similar situation might some day occur in the consumer credit market. More data and studies are needed to examine the dimensions of this problem.

*e. The Costs of Capital Markets.* Little is known to date on the benefits and costs of the elaborate financial mechanism which was erected in Brazil. That is, what are the benefits to the country of using this mechanism in creating demand and financing for the acquisition of goods vs. the costs, i.e., the income earned by those who run the financial institutions? Two recent studies have thrown some doubt on the benefits of the development of Brazil's capital market since 1964. Kenneth King has found that modernization of the financial sector has "... succeeded in the sense that it is now much more complicated than it was in 1964, but ... increased sophistication of financial intermediaries has not resulted in more resources being captured for financing private investment... in relative terms.... The financial system was expensive and ineffectual in 1964; in 1972 it is much more expensive and not much more efficient." [31] Wilson Suzigan and others have found that the financial reforms of the sixties did not have much effect on firms' financing out of retained earnings. These have been and still remain relatively high (averaging 48% in the period 1967-1970). The only notable change was the sources of financing external to the firm, which became more varied with the multiplication of financial institutions. The latter,

[30] Samuel Bowles, "Schooling and Inequality from Generation to Generation," *Journal of Political Economy* 80, n.º 3, pt. 2 (May-June 1972): 222; and Claudio de Moura Castro, "As Desigualidades na Distribuição de Renda" (mimeo., Rio de Janeiro: IPEA/INPES, 1972).

[31] King, pp. 48-49.

however, served mainly to finance current production and consumption rather than investments.[32]

It is also not clear how useful it was to create incentives to invest in the stock market, which resulted in the phenomenal boom of 1970-1971 and its collapse after mid-1971. Some have claimed that the stock market boom shifted resources away from more useful and less speculative sectors and that the collapse was a setback to those who were hoping to develop a mechanism for increasing the savings capacity of the economic system.

*f. Dependency.* During the post-1968 boom the presence of foreign capital has grown substantially. This is evident on the financial side from the growth of the foreign debt and on the real side from the expansion of the productive capacity of foreign firms. Some critics have called attention to the fact that this has increased the dependency of Brazil on other countries. The foreign debt reduces the government's political independence in dealing with creditor countries and institutions, while the growth of foreign affiliates means that there is an increased dependency on foreign technology and on decisions concerning the way a large part of the economy is run, i.e. the way its resources are allocated. Also, foreign firms tend to introduce consumption habits which some believe are unwarranted in a relatively low per capita income country.

Only further empirical studies can throw light on such concerns. Evidently the debt of Brazil is not as large as it at first seems when taking into account the country's reserves. Also, given the increased geographical diversification of Brazil's economic contacts, and given the nationalistic nature of the present regime, the amount of pressure which could be used by creditor countries or institutions is rather limited. As far as multinational enterprises with affiliates in Brazil are concerned, these have such large investments in Brazil that the government is in a strong bargaining position to make them do certain things deemed beneficial for the country, such as increasing exports, increasing technological research, etc. Only more research will throw more light on these issues.

*g. The Government or Foreigners?* Some economists have called attention to the fact that a trend observed since the fifties is becoming increasingly pronounced. The private Brazilian sector is relatively weak in terms of financial and human resources and is thus incapable of participating, to a large

32 Wilson Suzigan, José Eduardo de Carvalho Pereira, and Ruy Affonso Guimarães de Almeida, *Financiamento de Projetos Industriais no Brasil*, Relatório de Pesquisa, no. 9 (Rio de Janeiro: IPEA/INPES, 1972), pp. 364-66.

extent, in the most dynamic sectors of the economy, which require large amounts of resources and access to complex technology. Thus, the choice for Brazil is increasingly between Government and Foreign Enterprise.[33] This analysis rules out a number of other possibilities. For example, the growth of joint ventures between foreign and private domestic capital, with the latter becoming gradually dominant. Or, the growth of joint ventures between government and private foreign and/or domestic firms. These trends have become noticeable in the early seventies and could well lead to an industrial structure quite different from that known in the past.

*h. Are Continued High Rates of Growth Possible?* Assuming a continued strong and stable government and favorable balance-of-payment conditions, there is no need for growth to decline. In the first quarter of 1973 there existed enough basic projects to keep the economy going for many years at high growth rates: the growth of power capacity was to be assured continuance with the announced project at Itaipu; the great steel expansion program only began in the early seventies; the government road-building program was planned to continue into the mid-seventies; an institutional settlement of some of BNH's problems would assure a continued housing boom; vast urban transportation (the São Paulo and Rio subways) and other infrastructure projects are to be continued into the seventies. In the private sector, planned capital spending programs also seemed to guarantee substantial growth into the mid-seventies.

The only possible problem is the balance of payments. Whether the high rates of growth of export earnings can be maintained depends, in part, on factors over which Brazilian authorities have no control and, in part, on factors over which they could have some influence. Of course, the international price of raw materials and food products falls mostly in the former category. The exports of manufactured goods fall partially in the latter.

Brazil is still a marginal participant in world trade of manufactured products. In 1970 its share of the world market of manufactures amounted to only .1%. However, as this share grows, the possibility also grows of running into import restrictions in client countries. Also, it was found in a recent study[34] that a

33 Samuel A. Morley and Gordon W. Smith, "Import Substitution and Foreign Investment in Brazil," *Oxford Economic Papers* 23, n.º 1 (March 1971): 120-35.

34 Carlos von Doellinger *et al.*, *Transformação da Estrutura das Exportações Brasileiras, 1964-1970*, Relatório de Pesquisa, no. 14 (Rio de Janeiro: IPEA/INPES, 1973).

large proportion of Brazil's manufactured exports consists of products which have shown the least dynamism in the international market. Thus, future export growth will depend on efforts beyond export tax incentives and periodic mini-devaluations, which keep the *cruzeiro* from being overvalued. it will depend on the capacity of Brazilian exporters to improve the quality of their products, to offer generous credit terms to clients, and to provide technical assistance for servicing goods exported (especially the more complex consumer goods and capital goods). It will also depend on the willingness of multinational corporations with productive facilities in Brazil to export an increasing share of their output.

If export growth rates cannot be maintained, however, and the current account deficit worsens, the foreign capital necessary to counterbalance this might not always be available and the resulting balance-of-payments crisis might severely constrain the further rapid growth of the Brazilian economy.

# FOREIGN TRADE POLICY AND ITS EFFECTS *

*Carlos von Doellinger*

## 1 — INTRODUCTION

During the last ten years, Brazilian economic policy has been characterized by a rising "degree of openness" to foreign markets. In this new context, the guideline has been export promotion, as opposed to the introverted "import substitution" approach effective in the 1950's and early 1960's.

The ever-increasing need to export has resulted from the pressing necessity to expand import capacity, as indicated in the mid-1960's by government diagnoses of the Brazilian economy. These studies concluded that the country's import capacity would become the principal factor limiting the achievement of the desired product growth rate.[1] The alternative to the nonexpansion of exports was seen to be the stagnation already initiated in mid-1962.

Concomitantly, and as an obvious corollary to the new foreign market approach, import restrictions were gradually eliminated, though the first attempt to reduce tariffs substantially, in the 1967-1968 period, failed. The principle followed thereafter was one of "selective liberalization". Through various administrative mechanisms, the importation of capital goods and basic inputs was to be increasingly facilitated.

With regard to capital policy, the government sought to create legal and institutional conditions favorable to increasing the

* The present paper summarizes several chapters of C. von Doellinger, H. B. de Castro Faria and L. Caserta Cavalcanti, *A Política Brasileira de Comércio Exterior e Seus Efeitos*, 1967-1973, Relatório de Pesquisa, n.º 22 (Rio de Janeiro: IPEA/INPES, 1974).

1 A conclusion which was considered in the guidelines of the *Plano Estratégico de Desenvolvimento* of the Costa e Silva government.

inflow of such resources, for these were considered not only additional foreign reserves but added real resources as well. It can be observed from a reading of the 1964-1966 government plan (Plano de Ação Econômica do Governo — PAEG), for instance, that given the precariousness of the domestic capital market at the time, such resources were considered fundamental to the reactivation of the Brazilian capital formation process. Later on (1972), the government would reaffirm the important role played by foreign resources in the Brazilian economy.

The basic principle governing trade policy was diversification of exports in terms of products and markets. Accordingly, incentives were created to enable Brazilian products to compete on the international market. In practice, it proved possible to increase the profitability of export activities as well as the degree of competitiveness, since the incentives granted did not lead to proportional demand-price reductions.

The incentives established can be grouped as follows: fiscal, exchange, administrative (bureaucratic simplification) and financing (special financing favoring exports and export production). Regarding the establishment of these mechanisms, two basic stages can be distinguished in an *ex-post* view: the export "tax-lifting" stage, roughly corresponding to the period 1964-1968, and the export subsidy stage, beginning in 1969.

In the first stage, the government sought to remove the majority of heavy fiscal and administrative taxes levied on exports, and also tried, though in a faltering manner, to adopt so-called "exchange realism" through periodic devaluations of the *cruzeiro*. At the same time, subsidies to various types of imports were eliminated. Thus, this stage might best be considered as that in which distortions and anachronistic situations were eliminated in order to adjust to the new economic realities.

As of 1968-1969, the export policy was improved through the adoption of two measures: (1) the establishment of the so-called "flexible exchange rate", in fact an ever-declining exchange rate due to the chronic inflation, and (2) the creation of effective subsidies to manufactured exports, granted by the government act on fiscal credits decreed in March 1969. Thereafter, fiscal credits and income tax exemption, allowing cost reductions and generating appreciable profit margins, resulted in a growing share of exports in total industrial output.

This reinforcing of the policy was in great part motivated by the apprehension that the capacity to import would not be sufficient to recapture the high income and investment growth rates. At the same time, the accruing of other benefits to be

derived from greater participation in international trade was sought: new investment opportunities, better allocation of resources, and increased business efficiency. Agricultural exports, even of nontraditional products, were not directly considered in the incentive policy established. Nevertheless, this sector profited from the favorable international market conditions existing after 1967, enjoying significant price increases on products such as sugar, soy, beef, corn, fruit juices and cotton.

## 2 — EXPORT POLICY: A REVIEW

Before analysing the results of foreign trade in recent years, it is worth reviewing the post-war development of Brazilian export policy in order to acquire a comprehensive view of the current situation. The trade policy of the last 10 years is a perfect antithesis to that in effect prior to 1964. Until then, the single concern was to avoid substantial declines in foreign exchange revenue through measures that affected only certain exportable primary products, especially coffee. The solution of problems arising from the balance of payments was left to the "import substitution" mechanism.

As of 1964, however, the policy was reoriented so as to give more emphasis to export promotion. This new procedure has been progressively strengthened through the implementation of incentive measures. The results have been remarkably profitable. Whereas the average annual export growth rate did not reach 1.2% between 1947 and 1963, characterizing a poor performance even if compared to less developed countries, it rose to 15.8% in the next 10-year period (1964 to 1973) and to 25% between 1967 and 1973. It was in this last period that the most important fiscal incentives to exports were established. These figures suggest that, contrary to previous belief, the economic system had the capacity to respond to the incentives offered.

### 2.1 — The Post-war Foreign Exchange Policy

It can be argued that the 1946-1953 period was the most discouraging one regarding Brazilian export policy. The nontraditional products, which constituted a major item on the export list during the war, were especially affected. Fabrics, for example, represented more than 20% of total exports in the 1943-1945 period; by 1953 they accounted for only 1.4%. The decision to maintain the exchange rate at the 1937 level

(Cr$ 0.0186 per US$ 1.00), notwithstanding the already substantial national currency deterioration resulting from inflation, was greatly responsible for this outcome. In 1953 this rate represented, in real terms, less than 52% of its value in 1946.

However, the counterincentive represented by the decline of the real exchange rate was compensated for by foreign demand, which increased rapidly once freed of wartime restrictions. In addition, in the early 1950's the Korean war contributed to appreciable price increases on primary products. Thus, in spite of the discouragement to export diversification, an average annual growth of nearly 5% was sustained between 1947 and 1953, based on coffee, sugar, cotton, wood and other primary products. However, manufactured goods were gradually disappearing from the export list.

As to exports, it can therefore be said that the foreign policy of this period was the most disastrous in recent Brazilian economic history. It was as a consequence of the fixed exchange rate, observed for approximately nine years, that exports came to concentrate on coffee and other primary products. By the mid-1950's, when the international market was developing in an increasingly less favorable manner, the delayed effects of this policy began to be felt. Green coffee, which had accounted for less than 35% of exports in 1945, accounted for 71% in 1953, reflecting a dependence that has existed ever since.

## 2.2 — 1953 to 1963: 10 Years of Decline

The tardy exchange reform at the end of 1953, establishing multiple exchange rates, exchange auctions, and export subsidies, failed to modify substantially the already downward trend. While world trade expanded an average 6% annually between 1953 and 1963, Brazilian exports declined an average .9% per year despite successive readjustments in the exchange rate and subsidies. These readjustments gradually increased the real value of the established exchange rate (including subsidies) until it reached, in 1960, the 1946 level.

According to economic studies of the period, the decline in exports was due to unfavorable international market conditions, given the low income elasticities and the reduced prices of demand for primary products. In fact, the market conditions did exert pressure, but this was hardly a novelty. The share of primary products in international trade dropped from about 50% in the mid-1950's to less than 35% 10 years later. Yet, even assuming the complete impossibility of diversifying the list in favor of manufactured goods, diversification in the direction of other

primary products should have sustained an expansion of at least 2% per year, which was the average growth rate of the Brazilian agricultural sector.

By 1957 the government was already aware of the need for a fundamental change in its policy guideline. The creation of a federal commission in charge of promoting exports (Grupo de Trabalho de Fomento às Exportações – FOEXP) attests to this awareness. The suggestions of this commission, however, were conservative in scope and never implemented. But in this same year was enacted what was perhaps the first legal resolution to reduce export duties on manufactured products. It established the draw-back regime, which allowed tax exemption on imported inputs used in manufactured exports. The resolution was included in the Import Tariff Law. Although inoperative until 1961, when it began to be applied occasionally, this mechanism, together with the 1960 consumption tax (the current federal value added tax IPI) exemption for exported manufactures, formed the embryo of the fiscal incentive program established in 1964.

## 2.3 – The 1964-1968 Export Policy

As of 1964, Brazilian foreign trade policy began to follow a new approach. In addition to the periodic foreign exchange devaluations (replaced by the "flexible exchange rate policy" in 1968), the government endeavoured to reduce to the minimum the frequent obstacles to and the heavy duties on exports. These obstacles were principally in the fiscal and administrative areas.

Most of the measures adopted were based on suggestions which a group of exporters made, officially, the year before.

The main incentives gradually introduced between 1964 and 1968 can be briefly described as follows:

*Fiscal Incentives*

i) In June 1964, two new measures were adopted in the draw-back regime: automatic exemption from import duties, and refund of duties already paid.

ii) On November 30, 1964, export stamp tax exemption was established.

iii) On this same date, total exemption from the consumption tax (the current IPI) was reconfirmed and simplified.

iv) In June 1965, an income tax exemption mechanism came into effect. Each firm is allowed to deduct from its

income tax due a proportion equal to the share of exports in its total output. Although this measure should have been temporary (it was to remain in effect only until 1968), it has been deferred until it has become nearly permanent.

v) The state sales tax on exports was not waived until 1967. In 1965, the government had already defined the states' rights to levy taxes, limiting taxation on export products to the state of origin. On the other hand, several states agreed to exempt manufactured products (without extending exemption to the purchased raw materials); these included major exporters such as São Paulo, Minas Gerais, Guanabara, Rio Grande do Sul and Pernambuco. In 1967, the state value added tax (ICM) was substituted for the state sales tax (IVC), and exemption from it came to be determined by the Federal Constitution. Although this applied only to manufactured exports, several states once again gradually exempted primary products from such taxes: Rio Grande do Sul, São Paulo and Minas Gerais headed the list. The exemption from the state value added tax on raw materials was to become effective only three years later, after agreements had been reached between the federal and state governments.

vi) The export taxes still in force were abolished, in practice, only in 1966.

*Bureaucratic Simplification*

Attending to long familiar demands, the government introduced extensive reforms in the administrative areas linked to exports. The main steps taken were:

i) Centralization and simplification of administrative procedures, and

ii) Elimination of "visas".

*Quantitative Limitations*

Although appearing sporadically after 1964, especially with reference to beef, quantitative limitations became less frequent in this period. The rationale for lifting these was that the domestic market supply should be guaranteed by production increases and not by export restrictions.

*Credit Incentives*

The credit system is based on two principal measures: the financing of export production, and the financing of export activity proper, which benefits the foreign importer. In the first case, the interest rate on funds offered is highly subsidized: 8% per year, in nominal terms. In the second, the funds are offered at the international market interest rate level and, currently, at 10-year terms.

*Other Incentives*

i) Setting up of credit insurance for exports;

ii) Special priority to approval of industrial projects viewing exports on the part of government, executive and financial agents;

iii) Promotional campaigns to direct the productive system towards the foreign market, as well as to make the community aware of the pressing need to increase exports.

The highly favorable international market, which in this period expanded at an annual average of 8.0%, and the development of the domestic productive system must not be underestimated. Nevertheless, it is reasonable to credit the major part of increased Brazilian exports, especially of manufactured products, to the effectiveness of the incentives adopted. Total export growth averaged 7.2% yearly (opposed to the decline experienced up to 1963), while industrial export increase reached an annual average of 18.7%, as shown in Table 1.

Table 1

*Brazilian Exports, 1964-1968*

| Total Exports | Industrial Goods | | Coffee | |
|---|---|---|---|---|
| US$ Million | US$ Million | % in Total | US$ Million | % in Total |
| 1 429 790 | 133 051 | 9.3 | 757 788 | 53.0 |
| 1 595 479 | 203 111 | 12.7 | 706 797 | 44.3 |
| 1 741 442 | 188 310 | 10.8 | 795 839 | 45.7 |
| 1 653 751 | 244 816 | 14.8 | 704 498 | 42.6 |
| 1 881 344 | 263 931 | 14.0 | 775 114 | 41.2 |

Source: Carlos von Doellinger *et al*., *Transformação da Estrutura das Exportações Brasileiras, 1964-1970*, Relatório de Pesquisa, n° 14 (Rio de Janeiro: IPEA/INPES, 1973).

original 41

It is worth mentioning that total exports increased despite the decreasing share of coffee, whose trade revenue remained relatively constant. As a consequence, the export list became more diversified, mainly in the direction of industrial goods.

## 2.4 — Strengthening Export Incentives

In August 1968, a new exchange rate adjustment system was adopted. This system, which established more frequent devaluations of the domestic currency (generally every 40 to 50 days), permitted prompt readjustments of the exporter's revenue in real terms, and gave the government a better policy instrument. Officially known as the "flexible exchange rate policy", this is in fact the so-called "crawling-peg" exchange system.

Important additional fiscal incentives appeared in early 1969; these, known as "tax credits", eventually acted as veritable subsidies to the exportation of manufactures. In accordance, the firm is allowed to deduct from its federal value added tax (IPI) due an amount corresponding to the manufactures exported. This deduction, or credit, is computed on the basis of the FOB value of the exports and according to a maximum tax rate of 15%. The credit surpluses, if any, can be transferred either to later fiscal periods or to other industrial units of the exporting firm. The IPI credit is also granted on raw and packaging materials (except those imported) used in the production of the goods exported.

In early 1970, agreements between the federal and state governments resulted in the granting of similar credits in relation to the state value added tax (ICM).

In this way, exporters of industrial products benefited from exemptions and tax subsidies. Estimates indicated that full utilization of these incentives would enable exporters to place their goods abroad at FOB prices 40% to 60% lower than those of the domestic market.[2] The profitability of exports would thus be guaranteed.

The productive system once again proved to be highly elastic: total export growth reached 28% per year, while industrial product exports rose to an annual average of 53%. This resulted in greater diversification of the trade list, and in a higher share of industrial goods in total exports, as shown in Table 2.

2 See Carlos von Doellinger *et al.*, *Exportações Dinâmicas Brasileiras*, Relatório de Pesquisa, n.º 2 (Rio de Janeiro: IPEA/INPES, 1971).

Table 2

*Brazilian Exports, 1969-1973*

| Year | Total Exports | Industrial Goods | | Coffee | |
|---|---|---|---|---|---|
| | US$ Million | US$ Million | % in Total | US$ Million | % in Total |
| 1969 | 2 311 | 360 | 15.6 | 846 | 36.6 |
| 1970 | 2 739 | 527 | 19.2 | 982 | 35.9 |
| 1971 | 2 882 | 663 | 23.0 | 822 | 28.5 |
| 1972 | 3 990 | 1 182 | 29.6 | 998 | 25.0 |
| 1973 | 6 199 | 1 941 | 31.3 | 1 244 | 20.1 |

Source: Banco do Brasil, Carteira de Comércio Exterior BB/CACEX, *Comercio Exterior do Brasil*, 1969-1973.

The substantial increase in the profitability of export activity led to greater participation of Brazilian enterprises in the foreign market. Also, exporting was no longer the privilege of a few large companies, the majority of which used to consider foreign trade as a marginal activity. Table 3 illustrates this development from 1967 to 1970.

The participation of export firms rose substantially between 1967 and 1970, not only in absolute terms (number of exporters), but also in terms of the percentage of exporters in relation to the total number of industrial firms. In 1967 only one in 20 firms was engaged in exporting activities; by 1970 approximately one in five companies maintained such activities, and the total number of export firms had quadrupled.

Appreciable increases were also observed in all product categories, the increase in "Equipment and Vehicles" being outstanding. Whereas almost half the manufacturers were also exporters in 1970, less than one-sixth had sold to foreign markets in 1967. These results indicate that the export promotion policy did in fact attract a significant number of industrial producers over a short period.

## 2.5 — 1973: Investment Incentives

Despite the excellent results attained in these years, apprehension remained as to the long-term business attitude. For this reason, toward the end of 1971 the government offered new incentives to stimulate investments in exportable production activities. These were intended to make the entrepreneurs consider the foreign market in their decisions to expand productive capacity.

It was therefore established in September 1971 that manufacturers could import, free of tax, inputs in amounts up to

10% of their previous year's export *increases.* Such imports would no longer be subject to the restrictions imposed by the "law of similar product", which forbids the importation of certain goods also produced domestically. This exemption differed from the draw-back in that the inputs imported would not be bound to export transactions.

Table 3

*Export of Manufactured Products: Participation of Firms, 1967 and 1970*

| Manufactured Products | 1967 | | | 1970 | | |
|---|---|---|---|---|---|---|
| | N.º of Manufacturing Firms | | % | N.º of Manufacturing Firms | | % |
| | Exporters (1) | Total (2) | (1) (2) (3) | Exporters (4) | Total (5) | (4) (5) (6) |
| Chemical Products | 160 | 2 551 | 6.3 | 561 | 2 645 | 21.2 |
| Equipment and Vehicles | 420 | 2 556 | 16.4 | 1 195 | 2 548 | 46.9 |
| Manufactures Classified according to Raw Material | 322 | 9 238 | 3.5 | 1 404 | 10 075 | 13.9 |
| Miscellaneous | 245 | 7 615 | 3.2 | 1 133 | 7 070 | 16.0 |
| Total | 1 147 | 21 960 | 5.2 | 4 293 | 22 158 | 19.4 |

Source: BB CACEX. *Comércio Exterior do Brasil*, 1968-1971.

It was in 1972, however, that new and outstanding incentives to exports were created. These incentives were intended to benefit national and foreign companies already active in Brazil, foreign companies that wanted to "transfer" their operations to Brazil, and trading companies. The principal measures adopted were:

i) Incentives to expand productive capacity in order to export. These incentives could be obtained through the presentation of a plan (10-year minimum term), which, having been analyzed by a special interministerial group, might or might not be recommended to the Minister of Finance and the Minister of Industry and Trade for approval. The main benefits can be outlined as follows:

   a) Tax exemption on imports and on industrial products would be granted to companies whose export programs had been approved.

b) Such imports, of raw materials as well as equipment, would not be subject to the "law of similar product".

c) The income tax exemption corresponding to profits on exported production, which had thus far been established on a temporary basis, was renewed. In addition, the use of these exemptions as taxs credits was authorized.

d) IPI fiscal credits could be transferred to the next fiscal period and/or member firms.

e) The additional income tax levied on profits remitted abroad could be used as taxs credits. These credits would be reckoned according to a system similar to the one used to calculate the income tax exemption mentioned above.

f) The companies taking advantage of the program would clearly benefit from all the export incentives applicable to any exporting firm.

ii) Special incentives to transfer industries *operating in other countries* to Brazil.

This incentive program was aimed at attracting foreign industries to Brazil, where they would find better conditions for competing on the international market.

The productive capacity would thus be strengthened through the "importation" of complete industrial units already in operation in other countries. These units would not be subject to the "law of similar product", and would be exempt from import duties and federal value added tax, provided their production in Brazil were essentially destined for foreign markets. These exemptions would depend on approval by the President, subsequent to his conferring with the Minister of Finance and the Minister of Industry and Trade.

iii) Incentives to trading companies.

Until recently, almost all industrial export transactions were effected independent of trading companies. This was due to the limited export of manufactures produced by small-scale firms. Small and medium-size companies, in principle the ones that most needed intermediate trading channels, being unable to afford the additional investments indispensable to trading abroad, had little knowledge of the market.

This situation has clearly changed. Brazil now exports almost 10% of its industrial production, compared to less than

2% five years ago, and significant economies of scale in trading are expected. The experience of other countries, especially that of Japan, offers an important lesson on this subject. It was the Japanese trading companies that offered the leverage necessary to mobilize business for export activity. Seeking to profit from that experience, and considering the characteristics of the Brazilian market, the government decreed a law on trading company activities in the latter part of November 1972.

The main incentive given to such trading firms was the possibility of deducting from taxable profits an amount equal to the difference between the value of manufactures purchased from producers and the FOB value in national currency of the sale of the same products abroad.

In addition, the government placed at the disposal of these firms special credits for financing stocks purchased from producers.

The government also assumed the responsibility of setting up an extensive chain of export warehouses to be used by the trading companies.

## 3 — THE BRAZILIAN BALANCE OF PAYMENTS: 1964-1973

The extraordinary governmental emphasis given to trade policy, together with the results obtained regarding exports, might lead to the assumption that an extremely favorable balance-of-payments situation prevailed. In overall terms, this was so; however, frequently changing and singular situations are to be observed. Table 4 summarizes the principal Brazilian balance-of-payments accounts for the period 1964-1973.

The expansion of trade is immediately noticeable: exports plus imports reached US$ 12 391 million in 1973, representing an average annual growth of approximately 19.3% between 1964 and 1973. During this period the average GDP growth rate was 8.5% a year. These two rates of growth yield a coefficient of 2.3, which clearly indicates the recent tendecy to openness of the Brazilian economy.

Imports increased an average 21% per year, but exports grew only 17.5% per year. In 1971 and 1972 this resulted in trade deficits, which had been unknown in recent Brazilian economic history. Further expansion of imports was due both to the liberal policy adopted and to the strengthening of the economy through substantial increases in investments.

It was in the "Services" account, however, that increasingly significant deficits were reckoned in the items of "Capital Income Remittances", "Transportation", "International Travel"

Table 4

*Balance of Payments, Brazil, 1964-1973*

(US$ Million)

| Accounts | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|---|---|---|---|---|---|---|---|---|---|---|
| Exports (FOB) | 1 430 | 1 596 | 1 741 | 1 654 | 1 881 | 2 311 | 2 739 | 2 904 | 3 991 | 6 199 |
| Imports (FOB) | — 1 086 | — 941 | — 1 303 | — 1 441 | — 1 855 | — 1 993 | — 2 507 | — 3 245 | — 4 235 | — 6 192 |
| Trade Balance | 344 | 655 | 438 | 213 | 26 | 318 | 232 | — 341 | — 244 | 7 |
| Travel | — 3 | — 1 | — 31 | — 34 | — 121 | — 89 | — 130 | — 135 | — 178 | — 205 |
| Transportation | — 65 | — 27 | — 48 | — 54 | — 63 | — 135 | — 185 | — 255 | — 308 | — 618 |
| Insurance | — 11 | — 7 | — 4 | — 4 | — 9 | — 11 | — 13 | 7 | — 13 | — 19 |
| Capital Income | — 131 | — 174 | — 197 | — 257 | — 228 | — 261 | — 353 | — 420 | — 516 | — 632 |
| Government Transactions | — 20 | — 37 | — 54 | — 68 | — 63 | — 64 | — 69 | — 85 | — 135 | — 146 |
| Other Services | — 32 | — 116 | — 129 | — 110 | — 72 | — 70 | — 65 | — 70 | — 81 | — 44 |
| Transfers | 55 | 75 | 79 | 77 | 22 | 31 | 21 | 14 | 4 | + 28 |
| Current Transactions | 140 | 368 | 54 | — 237 | — 508 | — 281 | — 562 | — 1 307 | — 1 481 | — 1 629 |
| Capital Flow | 82 | — 6 | 124 | 27 | 541 | 1 022 | 1 155 | 1 957 | 3 714 | 3 963 |
| Investments | 28 | 70 | 74 | 76 | 63 | 136 | 122 | 168 | 312 | 941 |
| Long-term Loans and Financing (net balance) | — 56 | — 59 | 158 | 86 | 99 | 520 | 761 | 1 187 | 3 118 | 2 884 |
| Short-term Capital and Other Financial Flows | 110 | — 135 | — 108 | — 135 | 379 | 366 | 272 | 602 | 284 | 138 |
| Errors and Omissions | — 218 | — 31 | — 25 | — 35 | — 1 | — 20 | 92 | — 9 | 354 | — 155 |
| Total Balance (deficit —, or surplus +) | 4 | 331 | 153 | — 245 | 32 | 721 | 685 | 641 | 2 587 | 2 179 |

Source: Banco Central do Brasil, *Boletim* 1-10 (March 1965-1974).

and "Government Transactions". The "Capital Income account was in deficit as a result of the massive inflow of foreign capital. As to the remaining items, the deficits were due to the lack of these services in the country.

It should be noted, however, that the growing "Current Transactions" deficit was wholly financed by net capital inflow. Only in 1967 was a total deficit registered, but this was easily offset through the use of Brazilian foreign reserves.

During the period, net capital inflows were systematically greater than the "Current Transactions" deficits, allowing foreign reserves to accumulate. Such a situation was naturally favorable to foreign trade and financing. It should be pointed out, however, that these reserves were accumulated at the cost of increased indebtedness, and not as a result of positive net "Current Transactions". In 1972, for example, "Loans and Financing" represented 84% of the net capital inflow, and in 1973 it still accounted for 76%. The consequence was the growth of the so-called "debt-service" (interest and amortization), which may become a heavy burden if the inflow of funds continues to diminish, as observed in the last quarter of 1973.

Finally, it is important to note the substantial increase in the inflow of direct investments, especially in 1972 and 1973. It appears that in comparison to the trend which had prevailed up to 1971, the Brazilian economy became more capable of attracting risk capital.

Thus, the equilibrium in foreign transactions has been made possible not only by export expansion, but also through the inflow of financial resources and risk capital. The importance of maintaining the export drive becomes imperative. Exports should supply the funds necessary to import goods and services, as well as to pay for the "foreign debt service" which has accumulated in recent years. The following sections present a more detailed analysis of the export structure and export "growth sources". First, however, it would be interesting to examine the role of Brazil in today's international market.

## 4 — BRAZILIAN POSITION IN THE INTERNATIONAL MARKET

### 4.1 — Share of Foreign Trade in GDP

The effort made to expand foreign trade has resulted in a considerable elevation of the "degree of openness" of the economy. This coefficient, defined as the ratio of the mean value

of inputs plus exports and the gross domestic products, rose from 5.2% in 1967 to 8% in 1973. Although the 1967 figure stands somewhat below the average attained in the 1950's and 1960's, the considerable increase achieved in the last five-year period undoubtedly reflects the new economic policy.

In the international context, however, the Brazilian coefficient still appears rather low. Table 5 lists 25 countries that are either industrialized or in an advanced stage of industrialization for which it was possible to calculate degrees of openness. Only three countries — the United States, Mexico and Pakistan — presented lower coefficients than Brazil.

Table 5

*Degrees of Openness to Foreign Trade, 1971*

| Country | GDP (US$ Million) | Export X (US$ Million) | Import M (US$ Million) | $\frac{X + M}{2}$ / GDP (%) |
|---|---|---|---|---|
| United States | 1 046 800 | 44 137 | 48 520 | 4.4 |
| United Kingdon | 140 745 | 22 340 | 24 000 | 16.5 |
| Austria | 16 850 | 3 202 | 4 235 | 22.1 |
| Bel-Lux | 23 218 | 12 391 | 12 855 | 54.4 |
| France | 140 697 | 20 594 | 21 322 | 14.9 |
| Germany | 231 456 | 38 942 | 34 256 | 15.8 |
| Italy | 102 138 | 15 102 | 15 959 | 15.2 |
| Holland | 36 631 | 13 919 | 15 458 | 40.1 |
| Norway | 13 098 | 2 584 | 4 126 | 25.6 |
| Switzerland | 24 338 | 5 823 | 7 330 | 27.0 |
| Canada | 91 928 | 18 310 | 16 818 | 19 1 |
| Japan | 231 960 | 24 040 | 19 727 | 9.4 |
| Spain | 37 515 | 2 939 | 4 942 | 10.5 |
| Turkey | 10 267[a] | 677 | 1 171 | 9.0 |
| Australia | 38 576 | 5 231 | 5 266 | 13.6 |
| New Zealand | 6 491 | 1 359 | 1 346 | 20.8 |
| South Africa | 18 778 | 2 203 | 4 436 | 17.7 |
| Argentina | 20 300[a] | 1 740 | 1 888 | 8.9 |
| Brazil | 45 946 | 2 900 | 3 707 | 7.2 |
| Mexico | 36 461 | 1 501 | 2 407 | 5.4 |
| Venezuela | 11 685 | 3 125 | 2 071 | 22.2 |
| Malaysia | 4 056 | 1 636 | 1 434 | 37.9 |
| Pakistan | 17 014 | 666 | 917 | 4.7 |
| Philippines | 6 129 | 1 104 | 1 315 | 19.7 |
| Thailand | 6 883 | 833 | 1 287 | 15.4 |

Source: International Monetary Fund — IMF, *International Financial Statistics* 25, various numbers (1972).

[a] Estimate.

The average degree of openness for the 25 countries considered is 18.3%, and 22% if only the industrialized countries are taken into account. The weighted averages of these coefficients (using the GDP values as weights) are 10.7% and 10.6% for the 25 countries and the industrialized countries, respectively. Excluding the United States, the respective averages would be 16.8% and 15.6%.

It has been noted that the largest countries, in terms of territory and population, present lower degrees of openness. However, in view of the great variances observed in analyses based on cross-sections, this evidence alone does not appear to have normative value.

A probable increase in this coefficient is foreseeable for the near future in Brazil, given the recent tendency of the country's foreign trade to grow faster than its GDP. Nevertheless, the openness of the Brazilian economy is still below the average world standard.

## 4.2 — Brazilian Share of World Exports

The Brazilian share in total international exports has remained fairly constant. In 1972 this share was .9%, the same it had been in 1964 and 1967, and the figure can be taken as the average for the 1964-1971 period.

Table 6 shows the annual development of world exports since 1964. It can be noted that growth was clearly led by the industrialized countries, which controlled 74.4% of world trade in 1973.[3]

The performance of Latin America was poor, even in terms of developing countries. In contrast, the growth performance of Brazil attained a level equal to that of the industrialized countries.

# 5 — THE COMPOSITION OF THE EXPORT LIST

The analysis in this section refers only to 1967-1973, the period during which the Brazilian economy began to produce its most significant post-war results.

3 Excluding the Socialist countries, for which recent data was not available. It was not possible to calculate the figura for 1972 due to the lack of complete information.

## Table 6

### *World Exports, 1964-1971*

| Area | 1964 | | 1965 | | 1966 | | 1967 | | 1968 | | 1969 | | 1970 | | 1971 | | Average Annual Rate of Growth | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | US$ Million | | US$ Million | | US$ Million | | US$ Million | | US$ Million | | US$ Million | | US$ Million | | US$ Million | | 1964-1971 | 1967-1971 |
| World | 152 400 | 100.0 | 165 200 | 100.0 | 181 100 | 100.0 | 190 400 | 100.0 | 213 000 | 100.0 | 244 100 | 100.0 | 280 100 | 100.0 | 312 100 | 100.0 | 10.7 | 13.2 |
| Industrialized Countries[a] | 107 930 | 70.8 | 118 430 | 71.7 | 130 810 | 72.2 | 137 820 | 72.4 | 155 970 | 73.2 | 179 680 | 73.6 | 208 010 | 74.3 | 232 310 | 74.4 | 11.6 | 14.0 |
| Latin America[b] | 9 650 | 6.3 | 10 110 | 6.1 | 10 720 | 5.9 | 10 690 | 5.6 | 11 230 | 5.3 | 12 340 | 5.1 | 13 800 | 4.9 | 14 700 | 4.7 | 6.2 | 8.3 |
| Brazil | 1 430 | 0.9 | 1 596 | 1.0 | 1 741 | 1.0 | 1 654 | 0.9 | 1 881 | 0.9 | 2 311 | 1.0 | 2 739 | 1.0 | 2 888 | 0.9 | 10.6 | 15.0 |

Source: IMF, *International Financial Statistics* 26 (February 1973).

[a]USA, Canada, Western Europe (excluding Finland, Greece, Iceland, Ireland, Portugal, Malta, Spain and Turkey) and Japan

[b]South and Central Americas, including Haiti and the Dominican Republic (excluding other countries of the Caribbean).

## 5.1 — General Aspects

As shown in Table 7, Brazilian exports evolved from US$ 1 654 million in 1967 to US$ 6 199 million in 1973. This signified an increase of US$ 4 545.2 million in absolute terms, or about 274.8% in relative terms. The average growth rate was 24% per year, compared to 2.8% from 1957 to 1962, and 6.4% from 1962 to 1967.

The growth became more pronounced as of 1969, when exports exceeded US$ 2 billion, a level never reached before. Thenceforth, with the possible exception of 1971, the growth rate was maintained at a high level. By 1973 total exports exceeded US$ 6 billion, having nearly tripled in the four-year period from 1969 to 1973.

A more detailed analysis necessitates consideration of the principal items on the export list in order to examine the development, as well as the contribution to the overall growth, of each. Table 8 gives such information by sector. Since no complete product data was available for 1973, the 1967-1972 period was used.

Of the total US$ 2 337 million for the aforesaid period, US$ 743 million (31.8%) was provided by "Agriculture and Livestock", US$ 938 million (40.1%) by "Agro-industry and Traditional Industries", US$ 266 million (11.4%) by "Extractive and Mining Industries", and US$ 93 million (4%) by "Other Sectors". This last group presented the highest average growth rate (33.3%), followed by "Agro-industry and Traditional Industries" (31.7%), "Modern Industries" (29.4%), "Extractive and Mining

Table 7

*Growth of Brazilian Exports, 1957-1973*

| Year | Exports in US$ Million | Index (1957=100) | Change (%) | Average Annual Rate of Growth (%) |
|---|---|---|---|---|
| 1957 | 1 391.6 | 100.00 | | |
| 1962 | 1 214.2 | 87.25 | — 12.75 | —2.8 |
| 1967 | 1 653.8 | 118.84 | 36.20 | 6.4 |
| 1972 | 3 991.2 | 286.81 | 141.34 | 19.3 |
| 1973 | 6 199.0 | 445.46 | 55.33 | 24.0 |

Source: Ministério da Fazenda. Centro de Informações Econômicas e Financeiras — MF/CIEF, *Comércio Exterior do Brasil*, 1957-1973.

## Table 8

### *Brazilian Exports by Sector, 1967-1972*

| Sector | FOB Value (US$ Million) | | | | | | Average Annual Rate of Growth | Share in Total Exports (%) | | | | | | Average Share in Period | Breakdown of Average Annual Rate of Growth | Share of Sector in Rate of Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | (%) | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | (%) | (%) | (%) |
| Agriculture and Livestock[a] | 1 047 | 1 195 | 1 407 | 1 546 | 1 392 | 1 790 | 11.3 | 63.29 | 63.52 | 60.88 | 56.46 | 47.94 | 44.85 | 56.16 | 6.4 | 33.2 |
| Agro-industries and Traditional Industries[b] | 316 | 391 | 492 | 563 | 715 | 1 254 | 31.7 | 19.13 | 20.81 | 21.31 | 20.54 | 24.63 | 31.42 | 22.97 | 7.3 | 37.8 |
| Modern Industries[c] | 113 | 96 | 139 | 239 | 252 | 410 | 29.4 | 6.83 | 5.10 | 6.02 | 8.74 | 8.66 | 10.27 | 7.60 | 2.2 | 11.4 |
| Extractive and Mining Industries[d] | 149 | 171 | 226 | 315 | 358 | 415 | 22.7 | 8.98 | 9.06 | 9.76 | 11.49 | 12.32 | 10.40 | 10.34 | 2.4 | 12.4 |
| Other Sectors[e] | 29 | 28 | 47 | 76 | 187 | 122 | 33.3 | 1.77 | 1.51 | 2.03 | 2.77 | 6.45 | 3.06 | 2.93 | 1.0 | 5.2 |
| Total | 1 654 | 1 881 | 2 311 | 2 739 | 2 904 | 3 991 | 19.3 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 19.3 | 100.0 |

Sources: Calculated from data provided by BB CACEX, and BB.CACEX. *Relatório*, 1971.

[a] Includes raw agricultural products and frozen meat

[b] Includes food-processing industries, leather products, tobacco products (excluding cigarettes), wood natural textiles, clothing and footwear, and vegetable and animal fats, oils and waxes.

[c] Includes chemical industries (including plastics and pharmaceutical industries), synthetic textiles, basic metals and products thereof, machinery and instruments, electrical equipment, transport equipment and cigarettes.

[d] Includes vegetable extraction, fishing and mining.

[e] Includes rubber, paper and paper products, printing and publishing glass and nonclassified miscellaneous products. Special transactions are also included in this category.

Industries" (22.7%), and, lastly, "Agriculture and Livestock" (11.3%). It can be seen that the "Agriculture and Livestock" sector was the only one to have its share reduced – from 63.29% in 1967 to 44.85% in 1972 – as a result of its relatively low export growth rate. Nevertheless, a breakdown of overall export growth by sector – taking into account the weighted average share of each – shows that of the total of 19.3%, "Agriculture and Livestock" contributed 33.2%, second only to "Agro-industry and Traditional Industries", which contributed 37.8%. This means that if only the "Agriculture and Livestock" item had progressed as described above, total exports would still have increased at an average annual rate of about 6.4% in the 1967-1972 period, which would correspond to the 1962-1967 average index. Similarly, if only the exports of "Agro-industry and Traditional Industries" had risen, the average overall rate would have been around 7.3% per year. It can be concluded that, despite the great increase in the exportation of industrialized products in recent years, it was agricultural products, raw or semiprocessed, that were mainly responsible for the higher Brazilian export growth rate during the period.

## 5.2 – Destination of Brazilian Exports

As emphasized in a former study,[4] the growth of Brazilian exports initiated in 1964 was accompanied by significant relative changes in the composition of the import markets. Thus, for example, the lessened participation of the North American market was offset by greater diversification of Brazilian trade, especially in the direction of Asian and African countries.

The destination of Brazilian exports by major economic area is given in Table 9.

All markets showed increases in the values of goods imported from Brazil during the period under consideration. In absolute terms, the most significant were accounted for by the European Common Market (ECM), the United States, and the Latin American Free Trade Association (LAFTA). In relative terms, however, exports to the North American market presented the lowest growth rate (10.5% per year), resulting in its participation being reduced from 33.1% in 1967 to 22.6% in 1972. In 1969 this market was supplanted by the ECM, which maintained a stable average share of 27.7% throughout the period. Although

[4] Carlos von Doellinger *et al.*, *Transformação da Estrutura das Exportações Brasileiras, 1964-1970*, Relatório de Pesquisa, n.º 14 (Rio de Janeiro: IPEA/INPES, 1973).

## Table 9

*Destination of Brazilian Exports by Principal Economic Area, 1967-1972*

| Area | FOB Value (US$ Million) | | | | | | Annual Share (%) | | | | | | Average Share in Period | Average Annual Rate of Growth | Share of Area in Rate of Growth (% per Year) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | (%) | (%) | |
| United States | 547.6 | 627.0 | 609.8 | 676.0 | 760.0 | 901.0 | 33.1 | 33.3 | 26.4 | 24.7 | 26.4 | 22.6 | 27.7 | 10.5 | 2.9 |
| Canada | 16.3 | 26.3 | 28.6 | 40.6 | 42.8 | 51.8 | 1.0 | 1.4 | 1.2 | 1.5 | 1.5 | 1.3 | 1.3 | 26.0 | 0.3 |
| LAFTA | 61.2 | 193.1 | 254.1 | 302.9 | 354.7 | 414.6 | 9.7 | 10.3 | 11.0 | 11.1 | 12.3 | 10.4 | 10.8 | 21.0 | 2.3 |
| ECM | 452.0 | 479.5 | 683.0 | 770.5 | 793.8 | 1 136.3 | 27.3 | 25.5 | 29.5 | 28.2 | 27.5 | 28.5 | 27.7 | 20.0 | 5.5 |
| EFTA | 206,0 | 219.3 | 263.3 | 331.9 | 298,9 | 466,5 | 12.5 | 11.7 | 11.4 | 12.1 | 10.4 | 11.7 | 11.6 | 17.7 | 2.0 |
| COMECON | 97.0 | 121.4 | 129.0 | 123.5 | 128.9 | 231.2 | 5.9 | 6.4 | 5.6 | 4.5 | 4.5 | 5.8 | 5.6 | 19.0 | 1.0 |
| Japan | 56.1 | 58.6 | 105.3 | 144.9 | 158.4 | 191.4 | 3.4 | 3.1 | 4.6 | 5.3 | 5.5 | 4.8 | 4.5 | 28.0 | 1.3 |
| Other Countries | 117.8 | 156.1 | 238.1 | 344.5 | 344.1 | 594.1 | 7.1 | 8.3 | 10.3 | 12.6 | 11.9 | 14.9 | 10.8 | 37.0 | 4.0 |
| Total | 1 645.0 | 1 881.0 | 2 311.2 | 2 734,8 | 2 881,6 | 3 987,0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 19.3 | 19.3 |

Sources: Instituto Brasileiro de Geografia e Estatística — IBGE. *Anuário Estatístico*, 1972; and MF/CIEF, *Comércio Exterior do Brasil*, 1968.

the American share tended to decline, the United States continued to be a major market for Brazilian exports.

To corroborate these statements on market diversification, it should be observed that the item "Other Countries" showed the highest average annual growth rate (37%), followed by Japan (28%) and Canada (26%). The combined total share of these three groups almost doubled, rising from 11.5% in 1967 to 21% in 1972. The great increase of exports to "Other Countries" was due to the opening of new trade frontiers in Africa and Asia. Also, the European Free Trade Association (EFTA) and COMECON maintained nearly stable shares in the period 1967-1972 (11.6% and 5.6%, respectively). LAFTA behaved similarly, but demonstrated a slight upward trend according to the 1971 results (12.3%). Exports to this area averaged 10.8% of the total, with an average growth rate slightly superior to the overall rate (20% versus 19.3% per year). Finally, the contribution of each market to the overall export growth was calculated by weighting the regional growth rates by the respective average share in the period. It thus became clear that the ECM contributed the most (28.5%), followed by the group "Other Countries" (20.7%), the United States (15%), LAFTA (11.9%), EFTA (10.4%), and Canada, COMECON and Japan (13.5%).

## 5.3 — Agriculture and Livestock Exports

### 5.3.1 — Composition

As already observed, agricultural and livestock products were responsible for the greatest shares of export revenue; these, together with processed and semiprocessed agriculture products (agro-industrials), accounted for almost 70% of the export list in 1972. This is shown in Table 10. Manufactured products, or those not connected to agricultural and livestock activities, representend only about 20% of the total exports in 1972, and less than 15% in 1967. Therefore, nearly 64% of the average growth rate is "explained" by the group "Agriculture, Livestock and Agro-industries".

Table 11 lists the 10 leading products. It can be seen that despite the substantial reduction in the relative share of coffee, these products still comprised more than half of the total Brazilian exports.

Table 12 outlines the participation of Brazil in the international market with regard to the quantities (tons) of 25 of the major products exported in 1970.

Table 10

*Percentage Distribution of Exports by Sector, 1967-1972*

| Sector | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | Average Share | Average Annual Rate of Growth | Share of Sector in Total Rate of Growth |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture, Livestock and Agro-industries | 76.36 | 76.86 | 75.01 | 70.78 | 65.99 | 69.75 | 72.46 | 17.1 | 64.0 |
| Manufacturing Industries | 14.66 | 14.08 | 15.23 | 17.73 | 21.69 | 19.85 | 17.21 | 26.8 | 24.0 |
| Extractive and Mining Industries | 8.98 | 9.06 | 9.76 | 11.49 | 12.32 | 10.40 | 10.33 | 22.9 | 12.0 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 19.3 | 100.00 |

Source: Calculated from data provided by BB/CACEX, and BB/CACEX, *Relatório*, 1971.

Table 11

*Export of Selected Primary Products, 1967-1972*

(Values in US$ Million)

| Product | 1967 | % | 1968 | % | 1969 | % | 1970 | % | 1971 | % | 1972 | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coffee | 707 | 42.7 | 774 | 41.2 | 813 | 35.2 | 939 | 34.3 | 773 | 26.8 | 989 | 24.8 |
| Cotton | 91 | 5.5 | 131 | 7.0 | 196 | 8.5 | 154 | 5.6 | 137 | 4.8 | 189 | 4.7 |
| Beef | 4 | .2 | 13 | .7 | 28 | 1.2 | 63 | 2.3 | 99 | 3.4 | 169 | 4.2 |
| Cacao | 61 | 3.7 | 46 | 2.5 | 106 | 4.6 | 78 | 2.9 | 62 | 2.2 | 59 | 1.5 |
| Sugar | 84 | 5.1 | 104 | 5.5 | 117 | 5.1 | 132 | 4.8 | 146 | 5.1 | 314 | 7.9 |
| Soybeans | 29 | 1.8 | 6 | 3 | 29 | 1.3 | 27 | 1.0 | 24 | .8 | 128 | 3.2 |
| Sisal | 16 | 1.0 | 17 | .9 | 16 | .7 | 15 | .6 | 15 | .5 | 22 | .6 |
| Castor Oil | 23 | 1.0 | 36 | 1.9 | 45 | 2.0 | 38 | 1.4 | 39 | 1.4 | 54 | 1.4 |
| Soy Meal and Cake | 10 | .6 | 19 | 1.0 | 23 | 1.0 | 44 | 1.6 | 82 | 2.9 | 152 | 3.8 |
| Corn | 22 | 1.3 | 57 | 3.0 | 33 | 1.4 | 81 | 3.0 | 75 | 2.6 | 10 | .3 |
| Total | 1 047 | 63.3 | 1 203 | 64.0 | 1 406 | 61.0 | 1 571 | 57.5 | 1 452 | 50.5 | 2 086 | 52.1 |
| Total Exports | 1 654 | 100.0 | 1 881 | 100.0 | 2 311 | 100.0 | 2 739 | 100.0 | 2 882 | 100.0 | 3 989 | 100.0 |

Source: Calculated from data provided by BB/CACEX, and BB/CACEX, *Relatório*, 1971.

Since such products accounted for roughly 40% of the world agricultural and livestock trade, the effective share of Brazil in this total was only about 3.5% in 1970 (8.68% x .40%).

### 5.3.2 — The International Market for Agricultural Goods

Throughout the 1967-1972 period, the evolution of the market was highly satisfactory for nearly all agricultural goods, especially meat and soy. Brazilian sugar exports also benefited from the favorable market conditions in 1970 and 1971. The only exception among the group of 14 products for which information

Table 12
*Share of Brazilian Agricultural, Livestock and Agro-Industrial Goods in the World Export Market, 1970*

| Product | Quantity (%) |
|---|---|
| Sugar | 6.73 |
| Rice | 1.29 |
| Cacao | 10.55 |
| Bananas | 3.40 |
| Coffee | 29.28 |
| Citrus (oranges, tangerines, juices, etc.) | 1.25 |
| Soybeans | 2.29 |
| Soy Meal and Cake | 9.86 |
| Corn | 4.82 |
| Cotton | 8.56 |
| Peanuts | 5.45 |
| Meat (fresh and frozen) | 2.75 |
| Meat Extract | 7.01 |
| Peanut Meal and Cake | 14.02 |
| Tobacco | 6.06 |
| Pepper | 5.01 |
| Jute | .48 |
| Cottonseed Meal and Cake | 13.81 |
| Castor Oil | 82.77 |
| Cottonseed Oil | .46 |
| Sisal | 25.24 |
| Peanut Oil | 7.36 |
| Tomatoes | .92 |
| Tea | .55 |
| Total[a] | 8.62 |

Source: United Nations. Food and Agricultural Organization. *Trade Yearbook*, 1971.

[a] This total refers to the weighted average of the shares (expressed in quantity) of the various products listed, the weights being the shares in the total value of world trade.

is available was sisal, though by early 1973 it was on the list of goods with higher prices.

Table 13 shows the changes in the average prices (US$ per ton) of the major products exported between 1967 and 1972.

The export prices of sugar, coffee, soy, cotton, orange juice, wool, and Brazil-nuts rose considerably. This recent increase contrasts with the traditionally stable or declining trends in the international prices of the majority of these goods. In fact, with the exception of beef, the price of which experienced an average annual increment of 5.2% from 1953 to 1966,[6] most of the others were subject to less favorable market conditions.

The factors which could explain this reverse trend are yet to be determined, through it is known that the supply of certain goods diminished. For example, soy production dropped in the United States (in 1971-1972), and fish meal production was reduced in Peru, the latter leading to substitution by soy meal. The cacao supply was reduced by draught in the Central African countries, and the coffee supply by smaller crops in Brazil and

Table 13

*Average Prices of Agricultural and Livestock Exports, 1967-1972*

| Product | US$ Per Ton | | Percentage Change in Period |
|---|---|---|---|
| | 1967 | 1972 | |
| Sugar | 80.30 | 152.90 | 90.4 |
| Cacao | 517.30 | 578.50 | 11.8 |
| Coffee | 701.70 | 942.00 | 34.2 |
| Soy | 96.00 | 123.00 | 28.1 |
| Corn | 51.20 | 56.00 | 9.8 |
| Cotton | 479.50 | 663.00 | 38.3 |
| Peanuts | 229.50 | 244.00 | 6.3 |
| Orange Juice | 358.90 | 479.50 | 33.6 |
| Beef | 589.60 | 1 087.00 | 84.4 |
| Wool | 947.40 | 1 108.60 | 17.0 |
| Sisal | 130.10 | 123.60 | — 5.2 |
| Cashews | 909.50 | 234.50 | 35.7 |
| Pepper | 635.30 | 888.80 | 39.9 |
| Brazil-nuts | 507.00 | 538.30 | 6.2 |

Source: Calculated from data provided by BB/CACEX, and BB/CACEX, *Relatório*, 1971.

[6] United Nations, *Conference on Trade and Development*, 2d sess., 1968, TD/97.

other countries. On the other hand, world demand expanded at increasing rates, particularly with regard to cereals, meat, soy, fruit juices (especially orange juice) and cacao.

Given the lack of more detailed information, it is difficult to speculate concerning future trends. Some observers argue that an increasing demand will support the rising price trend for at least some of these products (meat and cereals), and further maintain that the supply will only with difficulty adjust to the potential demand before the end of the decade. Others consider the present situation temporary; looking to past examples, they foresee a prompt normalization of the market, thought they admit the impossibility of prices returning to the mid-1960 levels. Experience suggests that prolonged price increases should be considered with some reserve.

### 5.3.3 — Price and Quantity Variations

The behavior of international supply and demand suggests that price variations can explain a great part of the export value increase observed between 1967 and 1972. Moreover, recent market conditions may be responsible not only for the price changes, but also for a greater supply elasticity of exportables. As shown below, Brazilian agricultural output has been recomposed so as to favor exportable crops.

In a preliminary attempt to quantify the variables for the export values between 1967 and 1972, the following exercise was developed.

Let:

$R_{67}$ = revenue from export of agricultural and livestock products in 1967 (US$ current values)

$R_{72}$ = *idem* in 1972

$P^i_{67}$ = price of product *i* in 1967

$Q^i_{67}$ = quantity of *i* exported in 1967

$Q^i_{72}$ = *idem* in 1972

$\Delta P^i$, $\Delta Q^i$ = increases in price and quantity of product *i* between 1967 and 1972

Then:

$$R_{72} - R_{67} = \Sigma_i P^i_{67}\, \Delta Q^i + \Sigma_i Q^i_{67}\, \Delta P^i + \Sigma_i \Delta P^i \Delta Q^i$$

That is, the export revenue change is given by the sum of three components. The first ($\Sigma_i P^i_{67}\ \Delta Q^i$) shows the effect of what might be termed the "quantitive component" of exports, which does not necessarily depend on higher prices. It might be explaned, for example, by factors favoring the Brazilian supply, such as reduced transportation and marketing costs, efforts made by the government and farmers to increase productivity and reduce costs, or even a policy granting subsidies to agriculture and incentives for the settling of new areas. But even if the quantitative increase were essentially "induced" by price increases, the relative size of this component would give information on the elasticity of supply.

The other components ($\Sigma_i Q^i_{67}\ \Delta P^i + \Sigma_i \Delta P^i\ \Delta Q^i$) show the changes resulting from price variations. The first ($\Sigma_i Q^i_{67}\ \Delta P^i$) gives the effect of price increases, assuming total inelasticity of supply, and the second shows the additional earnings derived from price and quantity variations.

The values of these three components were calculated for the group of the 17 major agricultural and livestock products exported by Brazil. The same calculation was made separately for coffee, since its position among Brazilian exports and in the international market is singular.

The results showed that the "quantitative component" represented 46.5% of the export revenue change observed between 1967 and 1972 for the 17-major-product group. This outcome suggests a total elasticity of demand for Brazilian products, as the country's share in the world market is very small. The "pure" price component $(\Sigma_i Q_{67} P^i)_i$ represented 23.6%, and the "price-quantity component" ($\Sigma_i \Delta P\ \Delta Q^i$) 29.9% of that export revenue change, since the effects of the three components were 11.3%, 84.8%, and 3.9%, respectively.

Thus although export price variations may have been directly or indirectly responsible for the major part of the revenue changes for the 17-product group, the "elastic response" of the farmers was almost as considerable. In relation to coffee revenue, it should be pointed out that nearly all the additional earnings were owing to price increases.

### 5.3.4 — The Share of Exports in Domestic Production

Unfortunately there is no complete data on agricultural and livestock production in recent years. The official statistics available at the time this article was written (July-August 1973) did not go beyond 1969. Nevertheless, an attempt was made to use some

estimates for 1971 (those for 1972 appeared to be less reliable).

Table 14 gives the percentage shares of exports in the output of selected Brazilian agricultural and livestock products in 1967 and 1971. According to this table, by 1967 or shortly thereafter the foreign market was already absorbing an important part of the Brazilian production of these goods, with the exception of rice.

Table 14

*Percentage Share of Exports in Total Quantity of Agricultural and Livestock Output (Selected Products), 1967 and 1971*

| Product | 1967 | 1971 |
|---|---|---|
| Cotton | 11.2 | 9.9 |
| Peanut Meal and Cake | 26.1 | 21.7 |
| Rice | 4.7 | 2.5 |
| Cacao | 58.5 | 56.5 |
| Corn | 3.4 | 8.9 |
| Coffee | 33.3 | 30.5 |
| Soy Meal and Cake | 60.0 | 50.7 |
| Beef | 0.5 | 6.9 |

Sources: Fundação Getúlio Vargas — FGV, *Conjuntura Econômica* 25 (February 1971); and MF/CIEF, *Comércio Exterior do Brasil*, 1967-1971.

### 5.3.5 — The "Recomposition" of Production

It would therefore be interesting to know to what extent the stimulus of foreign demand has provoked changes in the share of exportables in Brazilian agricultural and livestock production.

Given the lack of data for recent years, this survey is also necessarily limited to a few products.

Table 15 shows the growth of physical production between 1967 and 1972, distinguishing exportables from nonexportables, i.e. from those goods which are predominantly for domestic consumption.

The great difference between the percentage changes in exportable and nonexportable production clearly suggests the recomposition of Brazilian activity. There is extensive evidence that the phenomenon has recently (1973) intensified to the point of leading government authorities to impose restrictions on the exportation of several of these goods. The justification presented is that such exports would jeopardize the domestic supply and/or force prices to levels higher than tolerable if the internal stabilization policy is to be maintained.

Table 15

*Percentage Changes in the Quantities of Agricultural and Livestock Output (Selected Products), 1967-1972*

| Product | Change (%) |
|---|---|
| *Exportables* | |
| Coffee | 14 |
| Soy | 412 |
| Corn | 33 |
| Cotton | 32 |
| Beef | 28[a] |
| Cacao | — 26 |
| Peanuts | 21 |
| Oranges | 64 |
| *Nonexportables* | |
| Rice | —1 |
| Beans | —5 |
| Potatoes | 9 |

Source: FGV, *Conjuntura Econômica* 26 (February 1972).

[a] 1967 1971.

## 5.4 — Exportation of Manufactured Products

### 5.4.1 — General Aspects

The exportation of manufactures is becoming an increasingly relevant factor in the demand for such products in Brazil. As shown in Table 16, their share in the total industrial output doubled during the 1967-1972 period.

In this same period, the largest sectoral contributions to exports were made by "Metals", "Nonelectrical Equipment", "Chemicals", and "Food Products". These accounted for 74.7% of the total manufactures exported by Brazil in 1967. Up to 1970 these sectors maintained their share above the 70% level, and in 1972 they still contributed more than half of the industrial exports. [a]

[a] This behavior appears to have been the result of the recent dynamism of certain sectors (mainly "Clothing and Footwear" and "Textiles") and of the mediocre performance of "Metals" in 1971 and 1972, the latter due to an increase in the domestic demand which hindered the formation of exportable surpluses.

Table 16

*Share of Manufactured Exports in Total Industrial Product, 1967-1972*

| Year | Manufactured Exports (CrS Billion, at Current Prices) | Share in Total Industrial Product (%) |
|---|---|---|
| 1967 | 637.5 | 5.0 |
| 1968 | 867.9 | 4.6 |
| 1969 | 1 444.4 | 5.5 |
| 1970 | 2 406.6 | 7.0 |
| 1972[a] | 6 737.4 | 9.9 |

Source: FGV, "Contas Nacionais do Brasil," *Conjuntura Econômica* 25 (September 1971): 97.

[a] Estimate.

### 5.4.2 — Growth Sources of Manufactured Exports

By adopting the method widely used in aggregate analyses of growth sources, generally known as "constant-market-share analysis",[7] it was possible to evaluate the influence of supply and demand variables on the growth of Brazilian industrial exports.

The analysis attempts to divide into four parts the export growth observed between 1967 and 1971.[8] The first three parts show the effects of international demand factors, and the fourth shows the increase resulting from changes in the competitive capacity of Brazilian exports on the international level. The first three are the respective consequence of overall expansion of the international market, recomposition of the export list in favor of products considered to have a dynamic demand, and recomposition of the market itself in favor of areas considered to offer benefits in terms of international demand. These components having been quantified, the "residual" difference between their sum and the actual increase in the value exported will indicate the growth

[7] See J. David Richardson, "Constant-Market-Share Aanalysis of Export Growth," *Journal of International Economics* 1 (1971): 227-39.

[8] The unavailability of final data for 1972 precluded consideration of this year.

## Table 17

### *Brazilian Export of Manufactures by Sector, 1967-1972*

| Sector | 1967 | | | 1968 | | | 1969 | | | 1970 | | | 1971 | | | 1972* | | | Average Distribution in Period (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | US$ 1 000 | Distribution (%) | Share in Total Exports (%) | |
| Nonmetal Minerals | 4 599 | 1 85 | 28 | 7 385 | 2 67 | .39 | 7 873 | 2 15 | 31 | 9 444 | 1 78 | .34 | 17 639 | 2 60 | 61 | 20 710 | 1 95 | 51 | 2 17 |
| Metals | 50 938 | 20 45 | 3 08 | 35 595 | 12 86 | 1 89 | 53 866 | 14 71 | 2 36 | 112 183 | 21 00 | 4 10 | 67 618 | 9 87 | 2 33 | 103 773 | 10 05 | 2 60 | 14 85 |
| Nonelectrical Equipment | 29 361 | 11 79 | 1 78 | 31 212 | 11 28 | 1 66 | 44 304 | 12 10 | 1 92 | 65 047 | 12 23 | 2 37 | 77 054 | 11 36 | 2 65 | 99 830 | 9 67 | 2 50 | 11 40 |
| Electrical and Communications Equipment | 5 014 | 2 01 | .30 | 5 988 | 2 16 | .32 | 9 910 | 2 71 | .43 | 16 264 | 3 06 | .59 | 28 529 | 4 20 | 98 | 38 704 | 3 75 | 97 | 2 98 |
| Transport Equipment | 9 254 | 3 72 | .56 | 3 897 | 1 41 | .21 | 6 851 | 1 87 | .30 | 14 872 | 2 80 | .54 | 27 749 | 4 02 | 94 | 68 588 | 6 64 | 1 72 | 3 31 |
| Wood Products | 7 531 | 3 07 | .46 | 13 193 | 4 77 | .70 | 23 600 | 6 47 | 1 03 | 24 076 | 4 52 | 88 | 34 764 | 5 05 | 1 18 | 47 539 | 4 61 | 1 19 | 4 73 |
| Furniture | 767 | 11 | .02 | 502 | .18 | .03 | 584 | .16 | .03 | 1 512 | 28 | 06 | 2 793 | 41 | .10 | 3 727 | 36 | 09 | .25 |
| Paper and Paper Products | 1 613 | .65 | .11 | 1 374 | .53 | .08 | 3 356 | .92 | 15 | 6 244 | 1 17 | .23 | 5 704 | 84 | 20 | 75 097 | 7 43 | 63 | 1 09 |
| Rubber | 614 | 33 | .05 | 567 | .20 | .03 | 1 103 | 30 | 05 | 4 033 | 76 | .15 | 4 697 | 69 | .16 | 7 603 | 74 | 19 | 50 |
| Leather Products | 8 008 | 3 22 | 48 | 6 188 | 2 24 | .33 | 11 677 | 3 18 | 51 | 15 516 | 2 92 | 57 | 16 585 | 2 44 | 57 | 40 679 | 3 94 | 1 02 | 2 99 |
| Chemicals | 57 932 | 23 26 | 3 50 | 70 199 | 25 36 | 3 73 | 85 550 | 23 36 | 3 70 | 107 353 | 20 18 | 3 92 | 123 315 | 18 17 | 4 25 | 194 882 | 18 88 | 4 88 | 21 53 |
| Pharmaceutical Products | 2 472 | 93 | 15 | 2 115 | 76 | .11 | 3 867 | 1 06 | .17 | 1 736 | 89 | 17 | 6 541 | 96 | 23 | 6 195 | 60 | 15 | 88 |
| Cosmetics | 6 701 | 2 48 | 37 | 6 478 | 2 34 | .34 | 7 527 | 2 06 | .33 | 10 397 | 1 95 | 38 | 12 110 | 1 79 | 42 | 12 021 | 1 15 | 30 | 1 96 |
| Textiles | 10 559 | 4 24 | 64 | 13 227 | 5 14 | .76 | 17 654 | 4 82 | .76 | 25 783 | 4 85 | .94 | 40 339 | 5 95 | 1 39 | 77 953 | 7 55 | 1 95 | 5 43 |
| Clothing and Footwear | 692 | .28 | 04 | 912 | 33 | 05 | 2 601 | .71 | .11 | 11 273 | 2 12 | 41 | 43 215 | 6 37 | 1 49 | 84 870 | 8 22 | 2 13 | 3 01 |
| Food Products | 47 759 | 19 18 | 2 89 | 69 666 | 25 17 | 3 70 | 75 789 | 20 68 | 3 28 | 89 615 | 16 85 | 3 27 | 150 837 | 22 23 | 5 19 | 165 002 | 15 98 | 4 13 | 20 02 |
| Beverages | 737 | 30 | 04 | 751 | 27 | 04 | 913 | 25 | 04 | 1 477 | 28 | 05 | 1 780 | 26 | 06 | 2 065 | 20 | 05 | 26 |
| Tobacco | 831 | 33 | 05 | 787 | 28 | 01 | 1 177 | 32 | 05 | 1 378 | 26 | 05 | 1 843 | 27 | 06 | 2 303 | 22 | 06 | 28 |
| Publishing and Printing | 69 | 03 | 00 | 89 | 03 | 01 | 1 376 | 38 | 06 | 2 388 | 45 | 09 | 5 927 | 87 | 20 | 10 327 | 1 00 | 26 | 46 |
| Miscellaneous | 4 389 | 1 76 | 27 | 5 584 | 2 02 | 30 | 6 554 | 1 79 | 28 | 8 337 | 1 57 | 30 | 10 457 | 1 55 | 36 | 21 111 | 2 05 | 53 | 1 79 |
| Total | 249 034 | 100 00 | 15 06 | 276 810 | 100 00 | 14 71 | 366 219 | 100.00 | 15 90 | 531 953 | 100 00 | 19 41 | 678 491 | 100 00 | 23 37 | 1 032 485 | 1000( | 25.87 | 100.00 |

Source MF CIEF. *Comercio Exterior do Brasil*, 1967-1972.

resulting from the relative increase in "competitive capacity" (taken here in the broad sense).[9]

To this end, let:

$X_{71}$ = export value of Brazilian manufactures in 1971 (US$)

$X_{67}$ = export value of Brazilian manufactures in 1967 (US$)

$\alpha_i$ = average share of sector *i* in the total Brazilian manufactured exports

$\alpha_{ij}$ = average share of sector *i* exports directed to market *j* (country, region or economic block)

$r$ = average annual growth rate of world manufactured imports

$r_i$ = average annual growth rate of world imports of sector *i* products

$r_{ij}$ = average annual growth rate of *j* market imports of sector *i* products

Then:

$X_{67}(1 + r)^4$ = hypothetical revenue obtained by Brazil if exports expanded at the same average rate as that of the international market, and if the 1967 composition, in terms of products and markets, was maintained.

$X_{67}(1 + \Sigma_i\alpha_i r_i)^4$ = hypothetical revenue, taking into account sectoral differences (i) in international demand expansion and the effective average composition ($\alpha_i$) of the export list by sectors considered

$X_{67}(1 + \Sigma_i\Sigma_j\alpha_{ij}r_{ij})^4$ = hypothetical revenue, taking into account not only sectoral (i) but also market (j) differences in demand expansion, and considering the effective composition of the list by sectors and markets

From these three hypothetical values, the forementioned effects were determined as follows:

$A_1 = X_{67}(1 + r)^4 - X_{67}$ = "overall market effect"

[9] Resulting not only from simple price reduction, but also from other factors such as financing, improved product quality, guaranteed replacement parts for equipment, technical assistance, promotion, etc.

$A_2 = X_{07}(1 + \Sigma_i\alpha_i r_i)^4 - X_{07}\ (1 + r)^4 =$ "product recomposition effect"

$A_3 = X_{07}(1 + \Sigma_i\Sigma_j\alpha_{ij}r_{ij})^4 - X_{07}(1 + \Sigma_i\alpha_i r_i)^4 =$ "market recomposition effect"

$A_4 = X_{71} - X_{07}(1 + \Sigma_i\Sigma_j\alpha_{ij}r_{ij})^4 =$ "competitive capacity effect"

For the calculations, index *i* refers to each of the 20 industrial sectors already listed and *j* to the four largest markets for Brazilian exports: the United States and Canada, Western Europe, the LAFTA countries and "Other Countries". The average annual growth rates refer to the 1966-1970 period since there was no export product data available for 1971.

Accordingly, the following results were obtained:

| *Growth Component* | *Value in US$ Million* | % |
|---|---|---|
| $A_1$ "overall market effect" | 159 889.5 | 37.2 |
| $A_2$ "product recomposition effect" | 29 674.9 | 6.9 |
| $A_3$ "market recomposition effect" | --61 909.8 | —14.4 |
| $A_4$ "competitive capacity effect" | 301 802.5 | 70.3 |
| | 429 457.5 | 100.0 |

It should be observed that the combined demand effects accounted for less than 30% of the export value increase, whereas the competitive capacity figure accounted for 70.3%. The increase resulting from the product recomposition of the trade list was much less significant (6.9%), and that from the market recomposition had a negative sign.

However, it must be emphasized that such effects are not independent. The earnings derived from expanded competitive capacity ($A_4$) were only possible due to the diversification of the list, which meant that Brazilian exporters gave less preference to the American market. Even so, American imports attained the highest international growth rates in the period (17.6% per year). Consequently, the "recomposition" in the direction of less dynamic markets provoked a negative contribution of $A_3$.

The recomposition by product resulted in increased, but limited, earnings through simple market expansion. Nevertheless, some improvement was shown in terms of more dynamic exports, for in the 1964-1970 period this share had been negative. However, the supply and demand effects remained constant at 30% and 70%, respectively, during the 1964-1970 and 1967-1971 periods.

Considering long-term export promotion strategy, it becomes evident that such proportions will have to be altered. Up to now, Brazil has benefited from being a "marginal supplier" in the international market. The Brazilian share of the manufactured product market being only .1% to .2%, the international demand directed to the country can be considered "infinitely elastic"; consequently, exports can expand at rates well above those of the market simply through marginal earnings resulting from the dislocation of possible competitors. This explains the considerable earnings resulting from the competitive capacity effect.

For this pace to be sustained, however, improved orientation of potential exports, in terms of products and markets, becomes increasingly important. Incentives creating conditions favorable to the exportation of more dynamic products to more dynamic markets could be a significant factor in the strengthening of foreign trade policy. It does not seem desirable that a country aiming at increased participation in the international market be limited to exporting goods intensive in natural resources and unskilled labor; nor should it be restricted to exporting less technologically sophisticated products destined to be manufactured in Brazil by multinational firms (though the additional possibilities of such products should not be disregarded).

Moreover, it may become advisable or even compulsory to limit some of these exports, be it due to domestic scarcity, [10] to the preservation of limited natural resources, [11] or even to restrictions imposed by the international market. [12] Finally, the deriving of comparative advantages from the utilization of unskilled cheap labor is but temporarily desirable, and should be continued for a longer time only in some of the poorer regions of the country. In fact, the future challenge regarding foreign trade lies in the ability of the country to "create" its comparative advantages in the more dynamic and modern sectors, with emphasis on technology, skilled labor and greater share of industrial value added. To meet this challenge

10 By mid-1973 problems concerning the domestic supply had already arisen. For example, government officials announced the suspension of paper and cellulose exports on August 8, 1973. A similar measure had previously been applied to vegetable oil and livestock feed exports on July 23, 1973.

11 The exportation of semiprocessed wood products, as well as that of almost all types of leather products, was placed under severe restrictions. It is also expected that leather exports will be completely prohibited in 1975.

12 Some of these goods produced by traditional industries meet severe restrictions, other than tariffs, in the principal export markets. Textiles are an example of such goods.

would be to follow the experience of those countries which have developed the most successful long-term foreign-trade strategies.

Two studies appear to confirm the validity of the idea that maintaining long-term export growth requires recomposing the list in favor of more dynamic and sophisticated products and markets. The better known of these refers to Japan, and the other, less frequently cited but no less notable, to Spain. In both cases, the presence of the government, expressed through various types of incentives, was fundamental to the results obtained. [13]
Tables 18 and 19 illustrate the positions of these countries. With reference to Japan, for instance, "Light Manufactures" ("Textiles") predominated in 1953, whereas 10 years later "Heavy Manufactures" ("Machinery and Transport Equipment") and "Chemicals" accounted for 52.7% of the country's exports. Likewise, in 1958-1959 Spain obtained 54.1% of its export revenue from "Food Products", "Beverages", "Clothing", and "Leather Products";

Table 18

*Japan: Composition of Exports, 1953-1963*

| Sector | % of Total | | Average Annual Rate of Growth (1953-1963) (%) |
|---|---|---|---|
| | 1953 | 1963 | |
| Food Products | *9.4* | *5.3* | 11.2 |
| Fuel and Raw Materials | *3.5* | *1.7* | 6.9 |
| Heavy Manufactures and Chemical Products | *34.8* | *52.7* | *18.9* |
| Chemicals | 5.7 | 5.8 | 14.4 |
| Metal Products | 15.1 | 17.3 | 14.2 |
| Machinery and Equipment | 16.0 | 29.6 | 23.9 |
| Light Manufactures | *49.4* | *39.8* | *11.9* |
| Textiles | 36.1 | 22.9 | 8.9 |
| Nonmetal Products | 4.9 | 3.9 | 11.8 |
| Others | 8.4 | 13.0 | 20.1 |
| Miscellaneous | *.9* | *.6* | *8.0* |
| Total | 100.0 | 100.0 | 14.7 |

Source: Kiyoshi Kojima, "Japan's Trade Policy," *The Economic Record* 41, n.º 43 (1965): 54-71.

13 See Kiyoshi Kojima, "Japan's Trade Policy," *The Economic Record* 41, n.º 43 (1965): 54-71. On the Spanish experience, see the studies by J. B. Donges, including "From an Autarchic towards a Cautiously Outward-Looking Industrialization Policy," *Weltwirstchaftliches Archiv* 107, n.º 1 (1971): 33-75, and "Spain's Industrial Exports, an Analysis of Demand and Supply Factors," *ibid.*, 108, n.º 2 (1972).

Table 19

*Spain: Composition of Manufactured Exports, 1958-1970*

| Sector | % of Total | | Average Annual Rate of Growth (1958-1970) (%) |
|---|---|---|---|
| | 1958-1959 | 1969-1970 | |
| Food Products | 29.6 | 17.8 | 13.7 |
| Beverages | 14.7 | 4.4 | 5.9 |
| Tobacco | .1 | .2 | 24.0 |
| Textiles | 5.1 | 5.5 | 20.4 |
| Clothing | .6 | 3.0 | 40.2 |
| Footwear | .4 | 6.2 | 58.7 |
| Leather Products | 2.0 | 1.4 | 15.6 |
| Wood Products | 3.9 | 3.0 | 16.6 |
| Paper and Paper Products | .1 | .8 | 49.0 |
| Publishing and Printing | 3.9 | 3.8 | 19.3 |
| Rubber | .4 | 2.4 | 44.7 |
| Petroleum Products | 14.9 | 5.9 | 9.0 |
| Chemicals | 8.6 | 7.3 | 17.6 |
| Nonmetal Mineral Products | 1.0 | 2.0 | 27.7 |
| Iron and Steel | 2.9 | 2.5 | 17.6 |
| Nonferrous Metals | 5.6 | 2.7 | 11.3 |
| Metal Products | 2.2 | 4.1 | 27.2 |
| Nonelectrical Equipment | 2.0 | 9.3 | 38.3 |
| Electrical and Communications Equipment | 1.1 | 4.2 | 37.0 |
| Transport Equipment | .8 | 11.3 | 55.3 |
| Scientific Instruments | .2 | .6 | 35.8 |
| Other Products | .1 | 1.6 | 66.9 |
| Total Manufactured Exports (US$ Million) | 268.0 | | 19.6 |
| Total Exports (US$ Million) | 494.0 | 1 605.4 | 15.7 |

Source: J. B. Donges, "From an Autarchic towards a Cautiously Outward-Looking Industrialization Policy," *Weltwirtschaftliches Archiv* 107, n.° 1 (1971): 33-75; and *idem*, "Spain's Industrial Exports, an Analysis of Demand and Supply Factors," *ibid.*, 108, n.° 2 (1972): 193

but in 1969-1970 such merchandise represented only 29.1% of the list, while "Chemicals", "Equipment", "Electrical Equipment", "Transport Equipment" and "Scientific Instruments" represented 32.7% (12.7% in 1958-1960). In the period studied, the average annual total export growth rates for Japan and Spain were 14.7% and 15.7%, respectively — far above the international rates (7% to 8%).

### 5.4.3 — Comparative Advantages

The high percentage of some industrials in total exports, as shown in Table 16, suggests that Brazil currently enjoys comparative advantages in these products. It is clear that a large part of these exports come from industries linked to agriculture and livestock or from extractive industries. Connected to the first, there are "Food Products", "Textiles" and "Leather Products". Related to the

second are "Metal Products" and "Wood Products", as well as the majority of "Chemical Products" (including menthol, tanning and dyeing extracts, and vegetable oils and waxes), which are almost all semiprocessed goods. These industries are also characterized by the intense utilization of natural resources and unskilled labor, which are abundant factors in Brazil. Thus, the classical theory of comparative advantages fits the present case perfectly: each country should export mainly products intensive in its abundant factors and import those which are intensive in its relatively scarce factors. [14] A statistical test based on data referring to 1970 appears to confirm this hypothesis. [15]

The explanation, however, does not have such direct application to certain modern industrial areas such as "Nonelectrical Equipment", "Electrical Equipment" and "Transport Equipment". These appear to illustrate a recent phenomenon in the international division of labor — the product cycle theory. [16] According to this theory, the large international corporations have cost advantages in the production of certain goods, once they are able to obtain from their head quarters the right to supply "third country" markets as well as the country in which their headquarters are located. This phenomenon is mainly due to "technological gaps" which permit the developing countries to have cost advantages in some already "standardized" manufactured goods. Thus, countries like Brazil — which attracted a large number of international firms during its "import substitution phase" and which continues to do so thanks to market expansion — are in the position to complete the "product cycle", which tends to repeat due to the multiplication of new products and production techniques. Something like a "dynamic theory of comparative advantages" therefore emerges as a result of the increasingly active presence of the multinational firms in international trade. [17]

These conclusions depend as much on the majority participation of multinational firms in the manufacture of such

14 Reference is to the traditional version of the Hecksher-Ohlin theory.

15 For a more detailed analysis of the subject, see Doellinger *et al.*, *Transformação da Estrutura*, ch. 4, item 4.

16 A good concise explanation of the "product cycle" principle is presented by Raymond Vernon in *The Economic Environment of International Business* (New Jersey: Englewood Cliffs, 1972).

17 For a theoretical approach to the subject, see, for example, Roger W. Klein, "A Dynamic Theory of Comparative Advantage," *The American Economic Review* 63, n.º 1 (March 1973): 173-83.

exports [18] as on the characteristics of the products themselves. [19] Conspicious exceptions to the phenomenon do exist. In fact, analysis of the 1972 Brazilian export list revealed the possibility of new trends, judging from preliminary indications. Unfortunately, due to the lack of definitive and detailed data, it was impossible to complete this analysis in time for it to be included in this article. Nevertheless, for the period under consideration the conclusions drawn remain valid.

## 6 — STRUCTURE AND EVOLUTION OF IMPORTS

### 6.1 — Preliminary Considerations

The growing need to import goods and services for the operation of any productive system, especially in developing countries, is an accepted fact. According to recent studies which attempt to develop a more realistic theory of international trade, [20] there are two types of import necessities: (1) those resulting from the lack of certain natural resources such as ore, fuel, or adequate climate and soil, and (2) those resulting from inelasticities of supply. In some cases, substituting the latter with domestic production would be too costly, at least for the time being. All countries face these two necessities, but in proportions varying according to the characteristics of their economies.

Considering only the situation of developing countries, the second import necessity is embodied in the following product groups:

> *Products with a limited local market,* for which domestic investments directed to import substitution are not yet profitable, even with tariff protection and/or easy financing. Included in this group is a varied selection of consumer goods, inputs (special steel, chemical products, etc.) and types of capital goods infrequently used in the economy.
>
> *Products with "bottleneck points" regarding short-term production expansion,* including those already manufactured

[18] See Fernando Fajnzylber, *Sistema Industrial e Exportações de Manufaturados,* Relatório de Pesquisa, n.º 7 (Rio de Janeiro: IPEA/INPES, 1971).

[19] See Carlos von Doellinger, "Exportações Brasileiras: Diagnósticos e Perspectivas," *Pesquisa e Planejamento Econômico* 1 (July 1971): 83-140.

[20] See I. Kravis, "Availability and Other Influences on the Commodity Composition of Trade," *Journal of Political Economy* 64 (April 1956).

in the country but which for one reason or another remain relatively scarce. This scarcity may be owing to a temporary or chronic limited productive capacity (due to shortage of factors such as qualified labor, necessary equipment or design), or to certain economic policies.

- *Products dependent on "unknown" technology* which is difficult to acquire because of the existence of technological monopolies or because of the scarcity of "know-how" on the domestic and international markets.
- *Products imported seasonally or sporadically* to cover temporary shortages in the domestic supply.

It would be difficult to meet the necessities arising from the absolute scarcity of certain natural resources with anything short of a technological revolution. On the other hand, import needs should be expected to intensify as the economy expands. Both production and investment growth lead to increased demand, especially in systems subject to rapid and drastic changes. Since the country has opted for a more liberal import policy, the nonessential consumer goods will also be in greater demand thanks to increased income. This liberal policy might also explain part of the growing demand for capital goods and other products that could be substituted by domestic production.

It does not appear necessary to prolong this discussion in order to conclude that it is normal for a steadily expanding and relatively open economy such as the Brazilian one to increase imports.

## 6.2 — The Composition of the Import List

As mentioned previously, in the 1967-1972 period imports rose at an average annual rate of 24% (FOB current value). Tables 20 and 21 show the composition of the import list by sector and use, as well as the contribution of each group to the growth rate. [21]

[21] Using the formula:

$$\bar{r} = \sum_{i=1}^{n} \bar{\alpha}_i \cdot \bar{r}_i$$

where:

$\bar{r}$ = average annual growth rate of total imports
$\bar{r}_i$ = average annual growth rate of group $i$ imports.
$\bar{\alpha}_i$ = average annual share of group $i$ in total imports.

The contribution of group $i$ to the growth rate $r$ is given by the ratio $\frac{\alpha \ \bar{r}}{\bar{r}}$

# Table 20

## *Brazilian Imports[a] by Sector, 1967-1972*

| Sector | 1967 | | 1968 | | 1969 | | 1970 | | 1971 | | 1972 | | Average Share | Average Annual Rate of Growth | Share in Total Rate of Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | US$ 1 000 | % | US$ 1 000 | % | US$ 1 000 | % | US$ 1 000 | % | US$ 1 000 | % | US$ 1 000 | % | (%) | (%) | (%) |
| 0 — Special transactions | 10 698 | .74 | 3 830 | .21 | 6 778 | .34 | 14 451 | .58 | 13 026 | .40 | 19 794 | .97 | .54 | 13.1 | .3 |
| 1 — Livestock and Livestock Products | 38 625 | 2.68 | 38 658 | 2.08 | 34 404 | 1.73 | 48 710 | 1.94 | 49 624 | 1.53 | 47 879 | 1.13 | 1.85 | 4.4 | .3 |
| 2 — Vegetable Products | 226 343 | 15.70 | 230 192 | 12.41 | 213 439 | 10.71 | 188 785 | 7.53 | 207 132 | 6.40 | 236 527 | 5.60 | 9.73 | .9 | .4 |
| 3 — Fats and Oils (animal and vegetable) | 15 454 | 1.07 | 19 891 | 1.07 | 14 838 | .74 | 20 280 | .81 | 22 801 | .71 | 25 457 | .60 | .83 | 10.5 | .4 |
| 4 — Food, Beverages, Vinegar, Tobacco | 8 772 | .61 | 13 242 | .71 | 8 419 | .42 | 11 833 | .47 | 15 443 | .48 | 19 683 | .47 | .53 | 17.6 | .4 |
| 5 — Mineral Products | 193 962 | 13.46 | 256 531 | 13.83 | 259 969 | 13.04 | 301 085 | 12.01 | 406 107 | 12.56 | 499 438 | 11.82 | 12.79 | 20.8 | 11.0 |
| 6 — Products of Chemical and Allied Industries | 199 195 | 13.82 | 265 954 | 14.34 | 261 949 | 13.14 | 360 009 | 14.36 | 428 701 | 13.26 | 612 967 | 14.51 | 13.90 | 25.2 | 13.0 |
| 7 — Plastics, Cellulose, Ethers and Esters, Synthetic Resins and Resin Products, Rubber (natural, synthetic and substitutes for) and Rubber Products | 25 901 | 1.80 | 45 609 | 2.47 | 49 995 | 2.51 | 70 128 | 2.80 | 95 115 | 2.94 | 101 045 | 2.39 | 2.49 | 31.2 | 3.2 |
| 8 — Leather, Hides, Furs and Articles thereof (belts and saddles, travel bags, handbags, etc) | 836 | .06 | 1 345 | .07 | 1 216 | .06 | 2 090 | .08 | 2 824 | .09 | 4 738 | .11 | .08 | 41.5 | .1 |
| 9 — Wood and Wood Products, Charcoal, Cork and Cork Products | 1 197 | .08 | 1 601 | .09 | 1 617 | .08 | 3 439 | .14 | 3 239 | .10 | 5 745 | .14 | .10 | 36.9 | .2 |
| 10 — Paper making Materials, Paper and Paper Products | 43 673 | 3.03 | 57 009 | 3.07 | 52 306 | 2.62 | 63 856 | 2.55 | 83 209 | 2.57 | 106 985 | 2.53 | 2.73 | 19.6 | 2.2 |
| 11 — Textiles (materials and products) | 10 697 | .71 | 29 858 | 1.61 | 24 314 | 1.22 | 39 057 | 1.56 | 56 845 | 1.76 | 66 558 | 1.58 | 1.41 | 44.0 | 2.6 |
| 12 — Footwear, Hats and Similar Articles, Umbrellas and Sunshades, Prepared Feathers and Feather Goods, Artificial Flowers, Hair Products, Furs | 104 | .01 | 522 | .03 | 560 | .03 | 1 195 | .05 | 1 424 | .04 | 3 258 | .08 | .04 | 98.0 | .2 |
| 13 — Stone Products, Gypsum, Cement, Anhydrite, Mica and Similar Materials, Ceramics, Glass and Glass Articles | 8 256 | .58 | 9 704 | .53 | 15 602 | .78 | 19 408 | .77 | 22 888 | .71 | 33 303 | .79 | .69 | 32.1 | .9 |
| 14 — Natural Pearls, Precious and Semi-precious Stones and Similar Articles, Precious Metals and Products thereof, Imitations, Costumes Jewellery, Coins | 2 666 | .19 | 6 917 | .37 | 5 289 | .27 | 10 288 | .41 | 12 430 | .38 | 16 894 | .40 | .31 | 44.6 | .6 |
| 15 — Basic Metals and Products thereof | 173 697 | 12.05 | 201 588 | 10.82 | 257 849 | 12.94 | 329 956 | 13.10 | 430 873 | 13.32 | 461 783 | 10.93 | 12.21 | 21.6 | 11.0 |
| 16 — Machinery and Mechanical Appliances, Electrical Equipment, Parts | 319 566 | 22.17 | 444 587 | 23.87 | 540 668 | 27.13 | 712 652 | 28.43 | 904 438 | 29.82 | 1 399 903 | 33.14 | 27.44 | 34.3 | 39.2 |
| 17 — Transport Equipment | 118 119 | 8.20 | 159 375 | 8.59 | 171 587 | 8.61 | 195 083 | 7.78 | 270 897 | 8.56 | 350 156 | 8.29 | 8.34 | 24.1 | 8.3 |
| 18 — Instruments and Equipment (medical, surgical, photographic, cinematographic, TV, magnetic process, sound, acoustic, gauge, measuring, precision), Musical Instruments, Clocks, and Watches | 41 829 | 2.90 | 64 333 | 3.47 | 69 718 | 3.50 | 110 064 | 4.39 | 135 012 | 4.17 | 197 923 | 4.69 | 3.85 | 36.2 | 5.8 |
| 19 — Weapons and Ammunition | 1 359 | .09 | 3 884 | .20 | 2 654 | .13 | 4 069 | .16 | 5 836 | .18 | 8 887 | .21 | .16 | 45.5 | .2 |
| 20 — Miscellaneous Manufactures | 16 | .00 | 52 | .00 | 67 | .00 | 196 | .01 | 314 | .01 | 1 851 | .04 | .01 | 198.5 | .0 |
| 21 — Art Objects, Collector's Items, Antiques | | | | | | | | | | | | | | | |
| Total | 1 441 266 | 100.00 | 1 855 119 | 100.00 | 1 993 247 | 100.00 | 2 506 696 | 100.00 | 3 234 088 | 100.00 | 4 724 088 | 100.00 | 100.00 | 24.0 | 100.00 |

Sources : Calculated from data provided by BB CACEX, and, BB CACEX, *Relatorio*, 1971.

[a] Values at FOB current prices

Table 21

*Distribution and Growth of Brazilian Imports by Class of Use, 1967-1972*

(%)

| Class of Use | Share in Total US$ FOB Value | | | | | | Average Share in Period | Average Annual Rate of Growth | Contribution to Rate of Growth |
|---|---|---|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | | | |
| Capital Goods | 31.9 | 33.7 | 37.0 | 37.7 | 38.9 | 42.2 | 36.9 | 31.2 | 48.0 |
| Intermediate Goods | 52.6 | 53.1 | 49.5 | 47.5 | 45.3 | 42.7 | 48.5 | 18.9 | 38.0 |
| Consumer Durables | 3.8 | 4.0 | 4.4 | 5.3 | 6.3 | 6.6 | 5.1 | 38.6 | 8.0 |
| Consumer Nondurables | 10.4 | 9.2 | 8.1 | 8.1 | 8.8 | 7.7 | 8.7 | 16.9 | 6.0 |
| Others | 1.3 | .0 | 1.0 | 1.4 | .7 | .8 | .8 | | |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 24.0 | 100.0 |

Sources: Calculated from data provided by BB/CACEX, and MF/CIEF, *Comércio Exterior do Brasil*, 1967-1971.

It is clear that the importation of "Capital Goods" (groups 16 and 17 in Table 20, and the first line of Table 21) dominated, averaging 37% of the total value but explaining almost half of the total growth rate (48%). While they represented less than 32% of the list in 1967, they accounted for more than 42% in 1972. "Intermediate Goods" followed, but despite the fact that they contributed 48.5% of the total value, their growth rate was below the average. The shares of "Mineral Products" and "Chemical Products" were outstanding, at 12.8% and 13.9%, respectively.

Among the consumer goods there was an interesting occurrence. The "Consumer Durables" accounted for 8% of the total growth rate, while the "Nondurables" (principally "Food Products") accounted for only 6%, though their average share and growth rate were high. This can be explained by the liberal policy adopted and by income growth, as well as by the reduction in the prices of these goods.

The overall elasticity of imports in relation to the GDP (2.42) is evidence of the open nature of the recent Brazilian economic growth policy. In the first phase, the accelerated growth of exports led to the virtual elimination of foreign trade bottleneck, and from 1967 on they allowed for the increasing importation not only of essential goods and services, but also of consumer goods. This export-led growth contrasts visibly with the situation that existed from the post-war years to the mid-1960's, when the import substitution process prevailed. Table 22 illustrates this contrast

Table 22

*Elasticity of Brazilian Imports,* [a] *1953-1972*

| Ratio | Period | |
|---|---|---|
| | 1953-1967 | 1967-1972 |
| Total Imports/GDP | .29 | 2.42 |
| Imported Capital Goods/Gross Capital Formation | .20 | 1.84 |
| Imported Raw Material and Inputs/Industrial Production | .10 | 1.41 |
| Imported Consumer Goods/GDP | .69 | 2.53 |

Sources: MF/CIEF, *Comércio Exterior do Brasil*, 1953-1972; FGV, "Estrutura do Comércio Exterior do Brasil, 1920-1964" (mimeo., Rio de Janeiro, 1966); *idem*, *Conjuntura Econômica* 25 (September 1971): 97-109; *idem*, "Retrospecto 1971," *ibid.*, 26 (February 1972): 7-9; and *idem*, "Retrospecto 1972," *ibid.*, 27 (February 1973): 8-11.

[a] Ratio between average annual growth rates.

through a comparison of import elasticities (ratios between growth rates) in two distinct periods.

## 6.3 — Prices, Quantities and Quality

A simple analysis of the "quantum" and price indexes of imports clearly reveals the predominance of quantitative growth.

It should be noted that the nearly stable prices contrasted with the outstanding quantitative expansion, especially of manufactured products, as shown in Table 23. In this group, only "Electrical Equipment" and "Transport Equipment" enjoyed significant increases, the former with 11.3% and the latter with 23% in relation to the 1965-1967 base period. This may be partly taken as a result of simple quality changes, and this "quality effect" may continue to exert itself despite the use of a moving base.

To better illustrate this qualitative change, a comparison was made between the average value index of Laspeyers (1967 base) and a moving-base price index. Table 24 presents this comparison for some manufacturing sectors.

In terms of more technologically sophisticated products, the greatest price differences can be observed for "Chemical Products"

Table 23

*Imports: Quantum* (Q) *and Price* (P) *Indexes,*[a] *1967-1971*
(1965-1967 = 100)

| Year | Category of Imports | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | General | | Mineral Extraction | | Manufactured Goods | | Nonmanufactured Goods | |
| | Q | P | Q | P | Q | P | Q | P |
| 1967 | 115 | 102 | 99 | 104 | 119 | 101 | 111 | 105 |
| 1968 | 142 | 105 | 116 | 104 | 162 | 100 | 122 | 102 |
| 1969 | 148 | 103 | 126 | 98 | 173 | 99 | 112 | 99 |
| 1970 | 178 | 105 | 147 | 102 | 218 | 102 | 99 | 97 |
| 1971 | — | — | — | — | 289[b] | 101[b] | — | — |

Source: FGV. "Índices Econômicos Nacionais." *Conjuntura Econômica* 27 (May 1973): 150-84.

[a] Quantum index of tons imported, and price index according to prices in US$.

[b] IPEA estimate.

Table 24

*Imports: "Average Value" and Price Indexes*[a]

| Sector | "Average Value" Index (1971; 1967 = 100) | Moving-Base Price Index (1970; 1965-1967 = 100) |
|---|---|---|
| Chemicals | 149.8 | 80.4 |
| Metals | 103.8 | 125.7 |
| Nonelectrical Equipment | 119.9 | 101.4 |
| Electrical Equipment | 137.4 | 110.8 |
| Transport Equipment | 357.4 | 109.8 |
| Other Equipment and Instruments | 218.0 | — |

Sources: FGV, "Índices Econômicos Nacionais," *Conjuntura Econômica* 27 (May 1973): 150-84; and MF/CIEF, *Comércio Exterior do Brasil*, 1967-1971.

[a] According to values in US$ per ton.

and "Transport Equipment", followed by "Nonelectrical Equipment" and "Electrical Equipment"". On the other hand, some deterioration in the qualitative composition of "Metal Products" occurred owing to the massive imports of raw materials instead of processed metals. The contrary was true for "Chemical Products", among which the more expensive items gained an increased share; thus, for example, in 1971 organic compounds had an average value 141.7% higher than they had had in 1967.

## 6.4 — Manufactured and Nonmanufactured Imports

By 1971 manufactured goods already accounted for 80% of total Brazilian imports, and a study of their structure shows the rising importance of the "modern" industries — the metallurgical, chemical, and nonelectrical, electrical and transport equipment sectors. Tables 26 and 27 give the structure by industry and import "quantum" indexes, emphasizing the dynamism of these sectors. It is worth comparing these indexes with the manufactured product "quantum" indexes presented in Table 28.

As shown in Table 25, nonmanufactured imports were mainly comprised of fuels (crude petroleum being the most important item) and nonprocessed foods (chiefly wheat) of which the domestic supply is limited. It is to be noted that the relative shares of wheat and oil declined due to the accentuated growth of the products mentioned in Table 24.

Table 25

*Principal Nonmanufactured Brazilian Imports, 1966-1972*

| Product | 1966-70 | | 1972 | |
|---|---|---|---|---|
| | FOB Value (US$ Million) | Share in Total Imports (%) | FOB Value (US$ Million) | Share in Total Imports (%) |
| Wheat | 137.6 | 7.6 | 122.0 | 2.9 |
| Vegetable and Animal Products | 129.1 | 7.1 | 187.7 | 4.4 |
| Petroleum | 193.4 | 10.6 | 397.0 | 9.4 |
| Other Mineral Products | 50.2 | 2.8 | 95.0 | 2.2 |

Source. Banco Central do Brasil. *Boletim* 9 (March 1973)

## 6.5 — Import Sources

Table 29 shows the origins of Brazilian imports in the period studied by country and economic block.

It is interesting to observe the trend to diversification of supply areas, generally analogous to the diversification of export markets. On both sides of the trade relationship, the countries of the European Economic Community, as well as Japan, Canada and "Other Countries", have assumed an increasing importance. Yet, a difference can be noted: whereas Brazilian imports from LAFTA represented 13% of the total in 1967, they had dropped to 8.5% by 1972, due to an average growth higher only than that of the Socialist countries (COMECON).

Given these conditions, the Brazilian foreign trade balance has undergone certain modifications in recent years. Thus, as shown in Table 30, Brazil registered a deficit of US$ 25.8 million with the LAFTA countries in 1967, but a surplus of US$ 55.6 million in 1972. On the other hand, the surplus with the ECM had changed to a small deficit by 1972. Outstanding were the surplus in relation to the Socialist countries and the deficit in relation to the United States, the second being the main factor responsible for the overall negative balance in the latter year.

It therefore follows that the indiscriminate diversification of supply markets may not be the best pattern for policy. At times, the interest in acquiring goods and services from certain suppliers may not coincide with the immediate possibilities for exporting goods to the same markets, at least not in the same proportions. Although international trade is remarkably

## Table 26

*Distribution of Brazilian Imports [a] by Sector, 1966-1971*

| Sector | 1966 | | 1967 | | 1968 | | 1969 | | 1970 | | 1971 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | US$ 10⁶ | % | US$ 10⁶ | % | US$ 10⁶ | % | US$ 10⁶ | % | US$ 10⁶ | % | US$ 10⁶ | % |
| Metals | 189.2 | 12.6 | 169.5 | 10.2 | 197.4 | 9.3 | 245.7 | 10.9 | 333.6 | 11.5 | 442.8 | 12.0 |
| Nonelectrical Equipment | 182.8 | 12.2 | 229.0 | 13.7 | 357.8 | 16.8 | 396.6 | 17.5 | 510.1 | 17.6 | 757.4 | 20.5 |
| Electrical Equipment | 83.2 | 5.6 | 98.9 | 5.9 | 150.3 | 7.0 | 177.9 | 7.9 | 240.6 | 8.3 | 281.1 | 7.6 |
| Transport Equipment | 118.2 | 7.9 | 152.8 | 9.2 | 161.1 | 7.6 | 229.9 | 10.1 | 277.4 | 9.6 | 338.0 | 9.1 |
| Paper | 24.8 | 1.7 | 34.2 | 2.1 | 53.6 | 2.5 | 48.9 | 2.2 | 59.5 | 2.1 | 79.3 | 2.1 |
| Chemicals | 276.4 | 18.4 | 285.8 | 17.1 | 413.2 | 19.4 | 392.3 | 17.3 | 520.2 | 18.0 | 621.7 | 16.8 |
| Textiles | 4.1 | .3 | 9.6 | .6 | 28.5 | 1.3 | 25.1 | 1.1 | 34.8 | 1.2 | 41.4 | 1.1 |
| Food Products | 55.1 | 3.7 | 83.6 | 5.0 | 77.0 | 3.6 | 68.3 | 3.0 | 88.9 | 3.1 | 94.8 | 2.6 |
| Miscellaneous | 36.9 | 2.5 | 42.4 | 2.5 | 62.9 | 2.9 | 67.4 | 3.0 | 99.5 | 3.4 | 122.6 | 3.3 |
| Subtotal | 970.7 | 64.9 | 1 105.8 | 66.3 | 1 501.8 | 70.4 | 1 652.1 | 73.0 | 2 164.6 | 74.8 | 2 779.1 | 75.1 |
| Others | 41.7 | 2.8 | 64.8 | 3.9 | 84.7 | 4.0 | 83.8 | 3.7 | 111.8 | 3.9 | 176.0 | 4.7 |
| Total: Manufactured Goods | 1 012.4 | 67.7 | 1 170.6 | 70.2 | 1 586.5 | 74.4 | 1 735.9 | 76.7 | 2 276.4 | 78.7 | 2 955.1 | 79.8 |
| Total: Nonmanufactured Goods | 483.8 | 32.3 | 496.8 | 29.8 | 545.4 | 25.6 | 528.8 | 23.3 | 617.8 | 21.3 | 746.3 | 20.2 |
| Total Imports | 1 496.2 | 100.0 | 1 667.4 | 100.0 | 2 131.9 | 100.0 | 2 264.7 | 100.0 | 2 894.2 | 100.0 | 3 701.4 | 100.0 |

Source: IPEA.
[a] Current prices.

Table 27

*Quantum Indexes for Manufactured Imports, 1967-1971*

(1966 = 100)

| Sector | 1967 | 1968 | 1969 | 1970 | 1971 | 1967-1971 Average per Year (%) |
|---|---|---|---|---|---|---|
| Metals | 91.3 | 103.3 | 127.4 | 143.0 | 190.0 | 20.0 |
| Nonelectrical Equipment | 141.5 | 210.2 | 241.1 | 311.0 | 462.0 | 34.5 |
| Electrical Equipment | 115.9 | 164.7 | 197.0 | 254.0 | 297.0 | 26.5 |
| Transport Equipment | 107.1 | 112.0 | 152.0 | 177.0 | 216.0 | 19.2 |
| Paper | 133.0 | 215.0 | 194.0 | 227.0 | 303.0 | 23.0 |
| Chemicals | 108.0 | 174.0 | 173.0 | 244.0 | 292.0 | 28.2 |
| Textiles | 221.0 | 1 116.0 | 972.0 | 1 463.0 | 1 741.0 | 66.5 |
| Food Products | 141.0 | 135.0 | 132.0 | 155.0 | 166.0 | 4.1 |
| Miscellaneous | 95.0 | 140.0 | 143.0 | 204.0 | 251.0 | 27.5 |
| Other Manufactured Goods | 155.0 | 205.0 | 206.0 | 256.0 | 417.0 | 28.1 |
| | 116.0 | 157.0 | 176.0 | 223.0 | 289.0 | 25.7 |

Source: W. Suzigan *et al.*, *Crescimento Industrial no Brasil*, Relatório de Pesquisa, n.º 26 (Rio de Janeiro: IPEA/INPES, 1974).

## Table 28

*Output of Brazilian Manufacturing Industries: Quantum Indexes, 1967-1972*

(1966 = 100)

| Sector | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1967-1972 Average per Year (%) |
|---|---|---|---|---|---|---|---|
| Nonmetal Minerals | 99.5 | 125.6 | 136.6 | 150.7 | 168.0 | 190.5 | 13.9 |
| Metals | 99.6 | 123.7 | 132.3 | 140.1 | 161.3 | 179.9 | 12.6 |
| Nonelectrical Equipment | 97.7 | 119.8 | 132.6 | 154.5 | 198.8 | 246.2 | 20.3 |
| Electrical Equipment | 111.4 | 142.5 | 155.4 | 162.4 | 187.1 | 228.1 | 15.4 |
| Transport Equipment | 94.3 | 118.6 | 144.4 | 158.8 | 189.8 | 227.7 | 19.3 |
| Wood Products | 96.9 | 113.2 | 132.2 | — | — | | — |
| Furniture | 87.8 | 93.2 | 93.3 | — | — | — | — |
| Paper and Paper Products | 112.8 | 122.8 | 138.9 | 146.0 | 149.8 | 158.8 | 7.1 |
| Rubber | 104.1 | 125.0 | 131.3 | 153.4 | 171.8 | 197.9 | 13.7 |
| Leather | 106.7 | 120.1 | 120.6 | 125.4 | — | — | — |
| Chemicals | 100.5 | 118.4 | 134.2 | 159.6 | 176.5 | 204.0 | 15.2 |
| Textiles | 91.6 | 114.1 | 119.1 | 119.0 | 123.6 | 124.3 | 6.3 |
| Clothing and Footwear | 100.8 | 114.4 | 119.1 | 140.5 | 153.7 | 159.3 | 9.6 |
| Food Products | 112.1 | 120.6 | 136.7 | 147.8 | 149.9 | 170.3 | 8.7 |
| Beverages | 94.0 | 101.0 | 110.1 | 120.7 | 131.4 | 137.3 | 7.8 |
| Tobacco | 107.4 | 114.1 | 119.0 | 126.5 | 132.6 | 140.5 | 5.5 |
| Total | 101.7 | 118.9 | 131.3 | 145.0 | 159.6 | 180.3 | 12.1 |

Source: IPEA.

## Table 29

*Origins of Brazilian Imports by Main Economic Area, 1967-1972*

| Country or Economic Block | FOB Value (US$ Million) | | | | | | Share (%) | | | | | | Average Share in Period (%) | Annual Rate of Growth (%) | Share in Total Rate of Growth (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | | | |
| United States | 510.4 | 612.7 | 613.2 | 823.8 | 954.9 | 1 212.3 | 35.4 | 33.0 | 30.8 | 32.9 | 29.4 | 28.7 | 31.7 | 18.9 | 6.0 |
| Canada | 16.0 | 32.2 | 134.6 | 61.3 | 88.0 | 84.5 | 1.1 | 1.7 | 1.7 | 2.4 | 2.7 | 2.0 | 1.9 | 39.0 | 7 |
| LAFTA | 187.0 | 226.3 | 241.8 | 263.7 | 271.2 | 359.0 | 13.0 | 12.2 | 12.1 | 10.5 | 8.4 | 8.5 | 10.8 | 13.9 | 1.5 |
| ECM | 289.5 | 403.7 | 456.2 | 571.0 | 782.4 | 1 148.9 | 20.1 | 21.8 | 21.9 | 22.8 | 24.1 | 27.2 | 23.2 | 31.0 | 7.2 |
| EFTA | 161.5 | 221.4 | 272.4 | 309.3 | 404.0 | 494.2 | 11.2 | 11.9 | 13.7 | 12.3 | 12.4 | 11.7 | 12.2 | 25.0 | 3.0 |
| COMECON | 68.7 | 79.4 | 62.6 | 51.5 | 99.7 | 80.3 | 4.8 | 4.3 | 3.1 | 2.1 | 3.1 | 1.9 | 3.2 | 3.2 | 1 |
| Japan | 45.0 | 65.9 | 94.6 | 159.3 | 228.9 | 283.0 | 3.1 | 3.6 | 4.8 | 6.4 | 7.1 | 6.7 | 5.3 | 44.0 | 2.3 |
| Other Countries | 163.2 | 213.5 | 217.8 | 267.0 | 416.4 | 561.8 | 11.3 | 11.5 | 10.9 | 10.6 | 12.8 | 13.3 | 11.7 | 28.0 | 3.2 |
| Total | 1 441.3 | 1 855.1 | 1 993.2 | 2 506.9 | 3 245.5 | 4 224.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 24.0 | 24.0 |

Sources: MF CIEF, *Comércio Exterior do Brasil*, 1967, 1969 and 1970; and Banco Central do Brasil, *Boletim* 9 (March 1973).

Table 30

*Balance of Trade Deficits and Surpluses, 1967-1972*

| Country or Economic Block | US$ Million FOB | | | | | |
|---|---|---|---|---|---|---|
| | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
| United States | 37.2 | 14.3 | — 3.4 | — 147.8 | — 194.9 | — 311.2 |
| Canada | .3 | — 5.9 | — 6.0 | — 20.7 | 45.2 | — 32.7 |
| LAFTA | — 25.8 | — 33.2 | 12.3 | 39.2 | 83.5 | 55.6 |
| ECM | 162.5 | 75.8 | 226.8 | 199.5 | 11.4 | — 12.6 |
| EFTA | 44.5 | — 2.1 | — 9.1 | 22.6 | — 105.1 | — 27.7 |
| COMECON | 28.3 | 42.0 | 66.4 | 72.0 | 29.2 | 150.9 |
| Japan | 11.1 | — 7.3 | 10.7 | — 14.4 | — 70.5 | — 91.6 |
| Other Countries | — 45.4 | — 57.4 | 20.3 | 77.5 | 72.3 | 32.3 |
| Total | 212.7 | 26.2 | 318.0 | 227.9 | 363.9 | — 237.0 |

Sources: Same as Table 29.

multilateral at present, it still appears advisable to plan foreign trade strategy in such a manner as to incorporate elements to offset "unbalanced" trends.

## 6.6 — Explanatory Factors

Clearly, total import value is directly related to domestic product (or, more specifically, to the industrial product, since agricultural imports comprise a smaller share of the total) and to gross capital formation, and inversely related to the real exchange rate. The intensity of these correlations is in part accentuated or attenuated by governmental economic policy. This is indicated by data such as that included in Table 31.

Table 31

*Imports and Domestic Variables: Indexes, 1967-1972*

(1967 = 100)

| Year | Total Imports (Current US$ FOB) | Manufacturing Real Product | Gross Capital Formation[a] (1949 Prices) | Real Exchange Rate for Imports[b] |
|---|---|---|---|---|
| 1967 | 100.0 | 100.0 | 100.0 | 100.0 |
| 1968 | 128.7 | 115.5 | 126.7 | 100.4 |
| 1969 | 138.3 | 127.9 | 136.5 | 102.7 |
| 1970 | 173.9 | 142.2 | 157.7 | 96.5 |
| 1971 | 225.2 | 158.1 | 187.6 | 93.8 |
| 1972 | 293.1 | 187.4 | — | 88.3 |

Sources: FGV, *Conjuntura Econômica* 25 (September 1971): 97; and MF/CIEF, *Comércio Exterior do Brasil*, 1967-1972.

[a] Official figures on gross capital formation are available only up to 1969. Those given here for 1970 and 1971 were estimated by applying the method used by FGV to data obtained directly from IBGE, FGV and the Instituto Brasileiro de Siderurgia.

[b] The real exchange rate was obtained by deflating the effective import rates by the general wholesale price index.

## 6.7 — Tariff Protection

As a consequence of the 1966 tariff reform, from March 1967 to the end of 1968 the import tax rates remained at low levels compared to what they had been earlier and would be later.

The import tariff averages for product classes are presented in Table 32.

It should be noted that restrictions were lifted appreciably in 1967, reducing the average protection by almost 30%. The subsequent changes led to the tax rates given for 1973, which reflect the recent situation. However, the levels continue to be lower than those prior to 1967.[22]

Nevertheless, it is necessary to consider carefully the data presented. It is known, for example, that in many cases the nominal tariffs were higher than the actual ones, as exemptions and reductions were frequent. And estimates suggest that such

Table 32

*Import Tariffs by Class of Use of Goods, 1964-1973*

(Unweighted Average of Nominal Rates)

(%)

| Class | 1964-1966 | 1967 | 1973 (March) |
|---|---|---|---|
| Consumer Nondurables | 73 | 54 | 84 |
| Consumer Durables | 80 | 64 | 83 |
| Fuel and Lubricants | 65 | 48 | 25 |
| Intermediate Metal Goods | 47 | 34 | 49 |
| Intermediate Nonmetal Goods | 37 | 27 | 34 |
| Construction Materials | 62 | 44 | 47 |
| Capital Goods for Agriculture | 32 | 25 | 31 |
| Capital Goods for Industry | 49 | 36 | 44 |
| Capital Goods for Transport | 55 | 42 | 47 |
| Total Imports | 54 | 39 | 49 |

Sources: The data for 1964-1966 and 1967 was adopted from Paul G. Clark, "Brazilian Import Liberalization" (mimeo., Williams College, September 1967). The data for 1973 was compiled from the tariff legislation in effect in March of that year: Ministério da Fazenda: *Tarifa Aduaneira e Legislação Básica do Comércio Exterior*, 1972, vol. 1.

[22] The government expressed concern at the development and composition of imports in 1967 and 1968; in great part, these were a consequence of the new tariffs. The proportion of consumer goods, for example, rose from slightly more than 11% of the total in 1966 to 14.2% in 1967 and 13.2% in 1968, then dropped in 1969. It should be pointed out that the tariffs on consumer goods were raised above the levels in effect prior to the 1967 reform.

reductions resulted in the actual tariffs being about 60% of the nominal tariffs in effect for the three classes of capital goods.

Reductions can be considered even greater in the last few years, though it has still not been possible to obtain reasonable estimates. This expectation is based on the fact that government officials tend to allow complete tax exemption for projects having priority according to their criteria.

Moreover, the recent foreign exchange devaluation mechanism has itself contributed to reducing the real protection. The devaluations are generally inferior to the differences between the rates of growth of domestic and international prices, these differences being justified by the "productivity earnings" of the Brazilian economy. This argument could also be used to justify the reduction of tariff protection to Brazilian industries, from which it could be concluded that there was in fact an intention to manipulate the exchange rate to this end.

On the other hand, it could also be affirmed that such mechanisms appeared in 1967 or were strengthened thereafter. So it is possible that the 1966 decision to liberalize imports has not in fact been altered. What did occur was that as of 1968 *more selective* liberalization mechanisms began to prevail, be they sectoral (capital goods, industrial inputs, etc.), regional, or even designed to correct certain anomalies in the domestic supply.

If on the one hand such mechanisms permit the government greater control to attain its liberalization goals, on the other they may introduce certain distortions, insofar as they do not always follow the well-outlined sectoral and regional economic policies. Given these conditions, appreciable reductions in the nominal rates for certain groups of products may be preferable to high tariffs and specific exemptions, since well-defined criteria for the granting of such exemptions do not always exist.

Nonetheless, it can be concluded that liberalization has become a reality, be it through tariff reductions or through the utilization of selective mechanisms, and that this policy has undoubtedly contributed to the recent import expansion, though it is difficult to estimate in what proportion. This conclusion reinforces the idea that import substitution has not been effective in the last few years, not even in the sectors specified in official documents.

## 6.8 — Import Substitution

The mere fact that imports rise at rates far superior to domestic production, in general terms and for nearly all industrial sectors, suggests that import substitution has not been

one of the sources of industrial growth. Consider, for example, the data in Table 33, which indicates the share of imports in total domestic supply.

It should be observed that, aside from "Food Products", the net import/supply quotient increased in all sectors, and substantially in some. Even in those for which official plans saw additional possibilities for import substitution, such as "Metals" and "Chemicals", the higher "degree of openness" was evident.

A more complete, though less up-to-date, analysis was made by William G. Tyler, who detects the growth "sources" in the demand for manufactured products.[23]

Table 33

*Share of Brazilian Imports in Domestic Supply*[a]

(%, at Current Prices)

| Sector | 1967 | 1971 |
|---|---|---|
| Metals | 13.8 | 18.3 |
| Nonelectrical Equipment | 31.1 | 37.7 |
| Electrical Equipment | 12.3 | 22.0 |
| Transport Equipment | 11.7 | 14.5 |
| Paper and Paper Products | 8.2 | 13.5 |
| Chemicals | 17.3 | 17.7 |
| Textiles | .8 | 2.1 |
| Food Products | 3.1 | 2.5 |
| Miscellaneous | 17.2 | 29.7 |
| Total | 10.3 | 14.0 |

Source: Suzigan *et al.*, *Crescimento Industrial no Brasil.*

[a] The calculations are based on the following formula:

$$\frac{M_j}{M_j + P_j(1 - a_{jj}) - X_j}$$

where

$M_j$ = value of sector $j$ imports
$P_j$ = value of sector $j$ production
$X_j$ value of sector $j$ exports
$a_{jj}$ coefficient of sector $j$ self-consumption, derived from the input-output matrix prepared by the Conselho Interministerial de Preços of the Ministry of Finance.

23 "Structural Interdependence, Import Substituting, Industrialization and Manufactured Export Expansion of Brazil" (mimeo., Institut für Weltwirtschaft. Kiel University, 1972).

The method for measuring the contributions of increased domestic demand, exports and import substitution to industrial growth is based on the well-known formula developed by Hollis Chenery,[24] and includes modifications proposed by Samuel Morley and Gordon Smith.[25] These modifications are aimed at eliminating underestimates of the "import substitution effect" resulting from the failure to consider the intermediate supply effects. The method is presented in detail by Tyler, as well as by Morley and Smith.

Table 34 reproduces the final results obtained by Tyler.

Even without considering the above figures rigorously, it is interesting to note the "negative contribution" of import substitution to all sectors, but especially to "Metals", "Electrical Equipment", "Transport Equipment", "Chemicals", "Plastics", "Paper" and "Miscellaneous". Not even in "residual" terms was import substitution effective.

## 7 — FOREIGN TRADE STRATEGY: FINAL CONSIDERATIONS

The foreign trade policy has unquestionably benefited the national productive system. Larger markets, new investment opportunities, incentives to business efficiency and easier access to the international financing market have made the general orientation practically irreversible. Although the extensive substitution of imports in the 1950's consolidated the national industrial structure, it also caused serious distortions necessitating a radical change in the approach to foreign trade.

The main distortion emphatically mentioned in any study of the import substitution process was the lack of criteria for allocating scarce productive resources. Furthermore, any potential import substitution activities were overprotected through high import tariffs and/or administrative restrictions, while exports were simultaneously discouraged. As a result, society had to pay a high price for its economic development.

Yet, an interesting analogy exists between import substitution protected by tariffs and export promotion stimulated by subsidies. Both tariffs and subsidies raise the actual cost of

24 "Patterns of Industrial Growth," *American Economic Review* 50 (September 1960): 624-54.

25 "On the Measurement of Import Substitution," *American Economic Review* 60, n.º 4 (September 1970): 728-35.

Table 34

*"Sources" of Industrial Demand Growth, 1964-1969*

(%)

| Sector | Domestic Demand | Exports | Import Substitution |
|---|---|---|---|
| Nonmetal Minerals | 101.6 | 1.6 | — 3.2 |
| Metals | 114.4 | 5.8 | — 20.2 |
| Nonelectrical Equipment | 97.9 | 3.6 | — 1.5 |
| Electrical Equipment | 109.3 | 1.3 | — 10.6 |
| Transport Equipment | 108.6 | .5 | — 9.1 |
| Wood Products | 93.4 | 8.8 | — 2.2 |
| Furniture | 100.3 | .4 | — .7 |
| Paper | 108.1 | 1.8 | — 9.9 |
| Rubber | 103.2 | .2 | — 3.4 |
| Leather Products | 101.2 | .8 | — 2.0 |
| Chemicals | 108.2 | 2.5 | — 10.7 |
| Pharmaceutical Products | 99.3 | .9 | — .2 |
| Cosmetics | 100.7 | .3 | — 1.0 |
| Plastics | 110.8 | .5 | — 11.3 |
| Textiles | 100.0 | 1.8 | — 1.8 |
| Clothing | 99.8 | .6 | — .4 |
| Food Products | 97.5 | 2.8 | — .3 |
| Beverages | 100.6 | .4 | — .1 |
| Tobacco | 99.3 | .7 | — — |
| Publishing and Printing | 98.1 | .8 | — 1.1 |
| Miscellaneous | 114.2 | 2.6 | — 16.8 |
| Total | 104.1 | 2.3 | — 6.4 |

Source: W. G. Tyler, "Structural Interdependence, Import Substituting, Industrialization and Manufactured Export Expansion of Brazil" (mimeo., Institut für Weltwirtschaft, Kiel University, 1972), p. 20.

foreign currency, though with certain differences as to their effects. When an import is substituted by a domestic product through tariff protection, foreign reserves are saved but product costs are increased, the burden being paid by the direct consumers. On the other hand, if it is decided to export using government subsidies, higher actual import prices also result, but with the burden distributed throughout society. Hence, the promotion of exports must be within bounds so as not to continue to impose on society overly high costs for economic development.

Given these conditions, it would be advisable to set social limits considered bearable; well-defined sectoral criteria could

then be established according to these limits. It also appears reasonable that the government of a developing country should respect the basic rules of a market economy and try to analyze in detail the options most likely to keep its foreign transactions in balance. Such analyses should be made at the level of a sector, industry or even investment project, depending on the sophistication of the planning system or the degree of government involvement in economic activity.

In addition to these aspects, the higher degree of vulnerability of the economy, inherent to export-led growth, must also be considered. The economy benefits from periods of international euphoria, principally reflected in trade; likewise, it suffers from the adverse effects of recession due to the difficulty of "reconverting" the productive structure (when such "reconversion" is possible).

The international economic crisis initiated in 1973 has particularly affected countries with a high "degree of openness" to foreign markets, such as Japan, England and Holland. Therefore, the search for an outward-looking strategy for growth requires thorough studies of the international economy, including analyses of product markets and of the economies of the countries of major interest, forecasts regarding prices on basic products (imports and exports), and so forth. In the domestic sphere, the search calls for studies enabling the government to adjust economic policy to changes in the world economic situation.

Finally ,the directions of commercial and financial flows between Brazil and other countries and the various economic blocks deserve more attention, especially when multilateral world trade does not operate efficiently. Should such inefficiency come to prevail, bilateral or even barter arrangements may eventually be needed.

# AGRICULTURAL MODERNIZATION AND TECHNOLOGICAL DUALISM IN DEVELOPING COUNTRIES

*Ruy Miller Paiva* *

## 1 — INTRODUCTION

Efforts to develop the agricultural sector are currently being made in a number of countries, including Brazil, which enjoy the following conditions considered favorable to modernization: [1]

(a) a significant percentage of farmers willing to adopt modern techniques;

* A few years ago the author published a study on technological dualism entitled "Modernização e Dualismo Tecnológico na Agricultura", which appeared in *Pesquisa e Planejamento Econômico* 1, n.º 2 (December 1971) : 171-234. The model then developed was commented on by Prof. W. H. Nicholls in his article "Paiva e o Dualismo Tecnológico na Agricultura: Um Comentário," *ibid.*, 3, n.º 1 (March 1973) : 15-50, as well as by Prof. G. E. Schuh in "Modernização e Dualismo Tecnológico na Agricultura: Alguns Comentários," *ibid.*, pp. 51-93, and by the author's IPEA colleague C. R. Contador in "Dualismo Tecnológico na Agricultura: Novos Comentários," *ibid.*, 4, n.º 1 (February 1974) : 119-38. In sections 1 to 9 of the present paper, the author seeks to reformulate this model in regard to certain relevant points. He recognizes that he would not have been able to do so had it not been for these commentaries and the opportunity of discussing them with their authors. Special mention should be made of recent discussions with Claudio R. Contador, whose theoretical grasp of the subject was of invaluable aid in preparing this new version. Any errors or oversights remain the author's sole responsibility.

1 An extensive literature exists seeking to show that agricultural backwardness in developing countries is the result of the absence of these favorable conditions. This paper is not intended to prove empirically that the existence of these conditions is today a constant in many developing countries. Nor is it necessary to do so herein, for the aim of this study is to show that there is a point at which the modernization process becomes tied to the development of the nonagricultural sector, regardless of the existence of these conditions.

(b) a stock of modern techniques (provided locally or imported) [2] suited to different local conditions;

(c) availability of technical and financial assistance to provide farmers with the knowledge and funds required for the adoption of modern techniques.

Moreover, these countries generally present satisfactory total output growth rates of up to 8% or 10% a year. On the other hand, these same economies are also characterized by having a large percentage, from 40% to 50%, of their total manpower allocated in the agricultural sector, and a low export rate of agricultural goods, not exceeding 10% or 12% of the sector's output.

Given these conditions, agricultural modernization in these countries is progressing at a slow and uneven pace. One can observe that a small percentage of farmers operate at a very high technical level, making use of sophisticated instruments such as tractors and harvesters, in addition to fertilizers, pesticides, concentrated feed, etc. However a larger proportion are in the stage of technological dualism, that is, using modern and primitive techniques simultaneously, and a substantial percentage continue to use primitive methods, practicing what might be called "hoe agriculture".

A similarly uneven technological pattern is observable if one considers individual agricultural products. Thus, for some products, marketable production is possible only for farmers who modernize their activities, so that those using traditional techniques are necessarily eliminated. For other products, however, such elimination does not occur, and modern and traditional methods coexist in a typical state of technological dualism. In still other cases, only farmers using traditional methods are able to continue producing, for modern technology is not economically feasible.

The existence of dualism and the slow pace and uneven spread of modernization are not easily explained. When there are farmers willing to modernize their activities, when there is a stock of technological knowledge which can be applied economically, and when there are services to provide farmers with the necessary expertise, funds and materials, it would be reasonable to expect that modernization would occur at an intensive rate, and that

[2] Imported techniques are very important at the moment. Besides the use of machines in agriculture, there is also the utilization of pesticides, antibiotics and nutrients which can be imported an then used following slight adaptation. Poultry-raising presents an extreme case, it being possible to import selected breeds and nearly all the knowledge required to run a poultry farm efficiently.

farmers who were unwilling or unable to modernize would be eliminated from the market or become marginal producers. In such a case, therefore, one could observe a situation of economic maladaption and not of technological dualism.[3]

Economic theory does not provide a satisfactory explanation for technological dualism. In general, the theories which attempt to explain the agricultural modernization process say little about the problems encountered in developing countries. For example, the "diffusion model", for a long time a well-accepted theory, states that agricultural modernization operates simply through the spreading of techniques which result in higher land and labor productivity and, consequently, in higher financial returns for the farmer.[4]

Accordingly, economists have developed methods for measuring the relationship between these productivity values and the increases in farm incomes, firstly through research concerning the organization and management of agricultural properties, and later through studies of the economics of production.

Thus, output growth or agricultural modernization is not related to the choice of techniques, but to the allocation and factor mix, and to the productivity per unit of input, whether considering the single firm or the sector as a whole.

The limitations of this theoretical model became evident when it was seen that the spread of techniques did not result in agricultural modernization in underdeveloped countries, despite all the efforts expended during the post-war period in the forms of technical assistance and financing. Furthermore, this model cannot explain the existence of economic dualism in developing countries, for if the new techniques are more advantageous economically there should be nothing (given the forementioned items a, b and c) to prevent all farmers under similar ecological conditions from adopting them.

Professor T. W. Schultz has made a valuable contribution by relating agricultural improvement to the development of urban industrial centers. To explain regional differences in farm income in the United States, Professor Schultz shows that farmers located

3 Where technological dualism exists, traditional farmers do not necessarily become maladapted from the economic point of view. In principle, they obtain higher returns than they would were they to modernize their activities. If they are well located, enjoying favorable soil and climatic conditions, these returns may even reach satisfactory levels.

4 See Y. Hayami and V. W. Ruttan, *Agricultural Development: An International Perspective* (Baltimore: The Johns Hopkins Press, 1971).

in areas closer to urban industrial centers have access to more efficient factor and product markets, making it possible to adopt more efficient methods and thereby obtain higher production returns. [5]

In a subsequent work, Schultz shows that the growth possibilities of traditional agriculture are already exhausted as a result of the farmer's "resources and knowledge of the art". He also shows that in this kind of agriculture it is not possible to increase output by a mere reallocation of factors and that "additional income flows" are dependent on the low-cost availability of modern inputs (material inputs and new knowledge). [6] Thus, the solution of the modernization problem would depend on the possibility of providing farmers with new sources of production, that is, high-pay-off inputs and modern techniques suited to local farming conditions.

These theories demonstrating the importance of industrial centers and the dependence of modernization on the existence of high-pay-off modern inputs are relevant to an understanding of the modernization process in developing countries. However, they are not sufficient to explain certain problems which arise during the modernization process. For instance, there are countries that have these modern inputs available but are unable to impart them to a more significant percentage of farmers despite similar soil and climatic conditions, the farmers' willingness to adopt modern techniques and the availability of financial and technical assistance.

More recently, Hayami and Ruttan have developed Schultz's concept of high-pay-off modern inputs in greater detail. [7] They specify that these appear in response to the country's economic conditions and resource endowments. In this way, the limitations arising from the supply inelasticities of land and labor could be overcome by means of biological and mechanical innovations, respectively, permitting the growth and development of agriculture. Satisfactory agricultural development should thus depend merely on the adequate generation and adoption of techniques which result in the saving of scarce factors. "Failure to choose a path which effectively loosens the constraints imposed

5 See T. W. Schultz, *The Economic Organization of Agriculture* (New York: McGraw Hill, 1953).

6 T. W. Schultz, *Transforming Traditional Agriculture* (New Haven: Yale University Press, 1964).

7 *Agricultural Development.*

by resource endowments can depress the whole process of agricultural and economic development." [8]

Hayami and Ruttan's model is important in explaining the creation of new techniques, for it includes the mechanism by which public and private investments are directed to the solution of these problems. It is of little use, however, to those developing countries which already possess reasonable stocks of modern techniques and whose problem is how to encourage a greater number of farmers to use them in place of traditional methods. The fact that such modern techniques do not spread at a faster rate, despite farmer receptivity and the official efforts of technical and financial assistance, is not explained by this model.

To arrive at a more complete explanation of modernization problems in developing countries, it is necessary to include elements additional to those considered in existing models. This paper attempts to show that, under certain conditions, the modernization process is dependent on the development of the nonagricultural sector and is governed by a self-control mechanism. As modern techniques spread among a greater number of farmers, the lowering of product and traditional factor prices renders modern techniques less economically advantageous than traditional methods. Thus, there is a braking effect and a limit (or maximum degree) to modernization. Beyond this limit, further modernization is only possible when paralleled by growth rates in the nonagricultural sector (and/or export sector) high enough to permit absorption of the additional output and the labor surplus resulting from agricultural modernization.

This mechanism leads to a better understanding of the difficulties involved in agricultural modernization in developing countries. It also explains technological dualism as a stage in this process, rather than as a deficiency.

It may seem strange that previous models have failed to indicate the existence of this self-control mechanism. The explanation probably lies in the fact that countries which developed in the past, such as the United States and European countries, did not feel the full impact of this mechanism. In the past, the expansion of exports and the industrial revolution created pressure for greater volumes of food and raw materials at a time that there was no highly productive technology available to the agricultural sector. Even countries which have developed more

[8] *Ibid.*, p. 54.

recently, such as Japan, have not felt the effects of this mechanism due to high growth rates in their nonagricultural sectors. [9] However, the countries developing today face different conditions. Growth of the nonagricultural sector is now dependent on highly capital-intensive technology and no longer requires large-scale transfer of labor from the agricultural sector; and the latter now develops via highly productive techniques and less intensive use of labor. Given these conditions, the growth of the nonagricultural sector acts, through the sel-control mechanism, as a retraint on the process of agricultural modernization.

## 2 — OBJECTIVES AND BASIC DEFINITIONS

The specific purpose of this study, as previously stated, is to show that in a free-enterprise market economy the modernization of agriculture is tied to the growth of the nonagricultural sector through a "self-control mechanism".

The sections which follow establish the principles governing the "adoption" and "diffusion" of modern techniques and discuss in detail the assumptions underlying the "self-control mechanism". The final sections consider the implications of this model for agricultural policy, with specific reference to the Northeast of Brazil. However, before proceeding further it is necessary to define certain concepts used in this analysis.

A basic point is that modernization of agriculture occurs through diffusion among a greater number of farmers of new production techniques which, in addition to being more productive in physical terms, are also generally more capital-intensive than the so-called traditional techniques, which are based on land and labor.

Two elements should be taken into account in measuring the degree of agricultural modernization: (a) the share in production of capital stock and modern inputs purchased outside the agricultural sector, and (b) the percentage of farmers who have adopted techniques considered modern.

The first of these, the "capital intensity degree", can be measured using the agricultural capital to labor ratio. The second

[9] K. Ohkawa and B. F. Johnston, in their detailed analysis of Japanese progress, state that: "Expansion in the non-agricultural sector has, of course, proceeded a good deal more rapidly than in agriculture". "The Transferability of the Japanese Patterns of Modernizing Traditional Agriculture," in *The Role of Agriculture in Economic Development*, ed. Erik Thornbecke (New York: Columbia University Press, 1969).

element, the "diffusion degree", can be measured simply by the proportion of farmers who have adopted techniques considered modern. [10]

Taken singly, however, these measures do not provide a satisfactory index of agricultural modernization. The "intensity degree" indicates nothing concerning the differences in levels of modernization among farmers – differences which are considerable in developing countries. The "diffusion degree" ignores the use of techniques other than those considered basic to defining modern agriculture. Such techniques are, in fact, easily found due to the very diversity of modernization among farmers. Clearly, this drawback could be lessened using a more elaborate index in which weights were assigned to each measure.

In the discussion which follows, the "diffusion degree" is the prime element, and it is treated as synonymous with the "modernization degree". Only when necessary will specific reference be made to the "intensity degree". Also, there is no need for rigorous definition of so-called "traditional" and "modern" techniques. For the purpose of this study, what really matters is the direction of change – the transfer from one technique to another which is more productive in physical terms and which employs relatively more capital. Moreover, there is no need to quantify these factor ratios, except when illustrating certain special cases.

## 3 – ADOPTION OF MODERN TECHNIQUES

For purposes of simplication, the "adoption" and "diffusion" of modern techniques are considered herein as distinct phases in the modernization process.

"Adoption" is ultimately a microeconomic problem, for it essentially involves individual decisions made by farmers who determine, mainly on the basis of the prospect for economic advantage, whether or not they should change their techniques. "Diffusion", on the other hand, has macroeconomic characteristics, for modernization on the part of a great number of farmers depends on a number of other factors, as previously stated.

10 The definition of modernization adopted here emphasizes the technological side of the process. This is consistent with what occurs in developing countries, where the transition from traditional to modern farming begins with the purchase of a tractor, fertilizers and other modern inputs. The efficient use of these inputs is postponed to a second stage in the modernization process.

## 3.1 — The Relative Economic Advantage of Modern Techniques

In the case of adoption, it is assumed that the basic aim of the farmer who substitute new techniques for old ones is to obtain economic advantage. This advantage can be expressed in terms of output increases and cost reductions, i.e., by the expected additional net income. If the alternative techniques are classified as traditional or modern, [11] according to the proportions of traditional factors (land and labor) [12] and modern inputs (machinery, fertilizers, technical services, etc.) used in production, the following expression gives the condition necessary for substituting traditional by modern techniques: [13]

$$(Q^m \cdot P_q - X^m \cdot P_x^m) > (Q^t \cdot P_q - X^t \cdot P_x^t) \qquad (1)$$

where:

$Q^m$ = output quantity obtained with modern techniques
$Q^t$ = output quantity obtained with traditional techniques
$X^m$ = quantity of modern inputs
$X^t$ = quantity of traditional inputs
$P_q$ = product price
$P_x^m$ = price of modern inputs
$P_x^t$ = price of traditional inputs

This statement is extremely simplified, for it groups modern inputs under a single variable ($X^m$) and traditional factors under another ($X^t$). Moreover, it is assumed that only modern or traditional factors of production are used in each case. But strictly speaking, there are many inputs involved, each having its

11 There is no need at the moment for a rigorous definition clearly distinguishing these techniques.

12 Agricultural labor is classed as a traditional factor due to the fact that it is generally unskilled in developing countries. Should a more rigorous definition be required (as for the application of expression [2] in fn. 13), labor would have to be further classified according to skill.

13 The relative advantages of modern and traditional techniques could also be measured in terms of production costs, in which case the expression would be the following, using the same notation:

$$Q^m \left( P_q - \frac{X^m \cdot P_x^m}{Q^m} \right) > Q^t \left( P_q - \frac{X^t \cdot P_x^t}{Q^t} \right) \qquad (2)$$

own price. Also, both modern and traditional techniques employ both modern and traditional inputs, though in differing ratios. Therefore, the correct expression shoul be as follows:

$$(Q^m \cdot P_q) - \left( \sum_{i=1}^{n} X_i^m \, P_{xi}^m + \sum_{j=1}^{l'} X_j^t \, P_{xj}^t \right) > (Q^t \, P_q) - \left( \sum_{i=1}^{n'} X_i^m \, P_{xi}^m + \sum_{j=1}^{l} X_j^t \, P_{xj}^t \right) \qquad (3)$$

where:

$n > n'$

$l > l'$, in a ratio to be established

However, for present purposes a conceptual model explaining only the direction of changes is sufficient. The simplified expression (1) meets this purpose since it indicates the basic elements responsible for the economic advantage, or disadvantage, of modern over traditional techniques. It shows that this advantage depends on the following relations:

– the relative physical productivity of modern to traditional factors $\frac{Q^m/X^m}{Q^t/X^t}$ indicating that as the productivity of modern inputs rises (or diminishes), the economic advantages (or disadvantages) of modern technology increase (or decrease);

– the modern to traditional factor price ratio $\left(\frac{P_x^m}{P_x^t}\right)$ – indicating that a price drop in the latter (land and labor) in relation to the former renders the use of modern techniques economically unfavorable;

– product to modern input price ratio $\frac{P_q}{P_x^m}$ – indicating that when the price of a product rises in comparison to the latter, the economic advantage of modern techniques increases.

Thus, the economic advantage of modern over traditional techniques is basically dependent on the behavior of product prices and of the prices and physical productivity of modern versus traditional inputs. Changes in these relations are used in this study as fundamental elements in analyzing the diffusion process in agricultural modernization.

## 3.2 — The Subjective Cost of Transference

The adoption of modern techniques often requires changes in the farmer's life style and behavior which are confounded with his transference proper from one agricultural system to another. One must observe that the mere economic advantage of modern over traditional techniques will not be enough to induce the farmer to transfer. Thus, the difference must be great enough to act as an incentive for him to break the barriers which bind him to tradition, to overcome the difficulties which accompany such change, and to accept the sacrifices which have to be made in order to achieve success.

These difficulties become apparent in acquiring adequate technical knowledge, in obtaining sufficient material resources, in hiring responsible and efficient labor, in insuring a regular supply of good quality inputs (mainly pesticides, vaccines, feed and seedlings) and, above all, in the financial risk the farmer has to accept. The sacrifices are related to the "advantages" the individual feels he will lose by breaking away from a traditional way of life, from the habits and customs that he must abandon to operate as a modern farmer.

These difficulties and sacrifices may be considered the "subjective cost of transference" (SCT). [14] It can therefore be argued that a farmer's decision to adopt modern techniques depends not only on their relative economic advantage, but also on the possibility of their compensating for those difficulties and sacrifices, that is, for the farmer's subjective cost. Accordingly, equation (1) is restated as follows to include this new condition necessary for transference: [15]

$$(Q^m \cdot P_q - X^m \cdot P_x^m) \geq (Q^t \cdot P_q - X^t \cdot P_x^t) + SCT \qquad (4)$$

In addition, it must be noted that the subjective cost of transference is different for each farmer, depending on his skill, environment, interpersonal relationships and, above all, cultural level. The fact is that some farmers transfer as soon as they judge that economic returns from modern agriculture are higher than those

[14] Other cost elements could be considered in this definition, such as the difficulties resulting from the indivisibility of certain fixed-capital items and the farmers' slight interest in distinguishing long-term and short-term costs. However, such elements seem to have relatively little importance in the process of transferring from traditional agriculture in developing countries.

[15] Note that according to the original equation (1) there would be no transference if incomes were equal.

from traditional agriculture. Others take more time, and only make the change when the expected relative advantage is very high.

Thus, the subjective cost of transference for a group of farmers can be shown by a curve such as (CC) in Figure 1. The curve indicates that some farmers have a negative transference cost, meaning that they are willing to change even if only for the sake of gaining "prestige" and the reputation of being "innovators". For others, the cost is excessively high. The slope of the curve depends on technical and credit assistance, on the farmers' educational level, and on the force of tradition, in addition to other factors. As the service facilities improve and the cultural level rises, the curve shifts to the right (C'C').

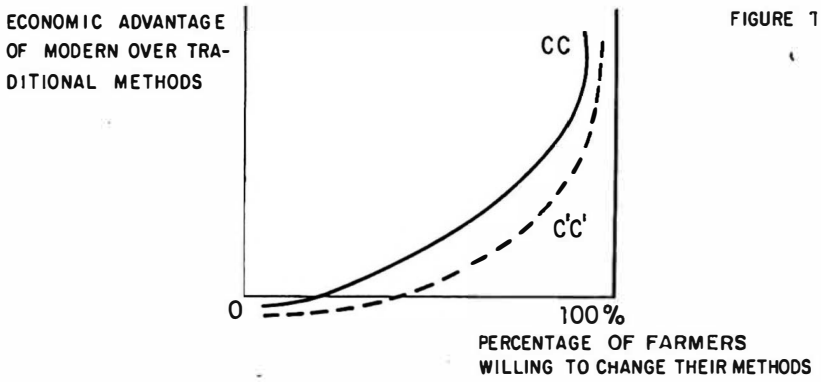



FIGURE 1

## 4 — DIFFUSION OF MODERN TECHNIQUES

It has already been stated that diffusion of modern techniques is a more complex process than adoption. Besides the economic advantage that modern methods must offer, diffusion depends on a number of other conditions, such as availability of material resources and technical knowledge, an adequate supply of modern inputs, credit facilities and the managerial ability of farmers. These conditions are essential to the diffusion of modernization, and developing countries attempt to make them available to farmers.

However, there is a conditioning factor in the modernization process of greater importance which has not been sufficiently considered by those studying modernization problems. It consists

in the fact that the diffusion of modern techniques provokes changes in the product to traditional factor price ratios. These changes have a braking effect on diffusion until further changes in prices or techniques occur. In principle, this follows a pattern that can be briefly described as follows:

with the diffusion of modern technology, output increases and product prices decrease; [16] as diffusion progresses, this is followed by relative declines in the traditional factor prices (land and labor);

when product prices fall (changing the ratio $P_o / P_x^m$), the advantage of modern technology is thereby reduced, as shown previously;

later, when the prices of traditional factors also fall (altering the ratio $P_v^m / P_x^t$), the advantage of modern technology is further reduced and may even become negative.

Such drops in product and traditional factor prices cause modern techniques to become economically less advantageous, or even disadvantageous, in comparison with traditional methods, and thereby act as a king of "brake" or counterincentive to modernization, reducing the number of farmers interested in changing their systems of production.

From the pattern just described, the following significant inferences may be drawn:

the modernization process is subject to a "self-control mechanism", for the counterincentives (drops in product and factor prices) are inherent to the process;

the diffusion of modern methods has a limit or "maximum degree" set by this self-control mechanism;

once the maximum degree has been reached, further diffusion becomes basically dependent on development in the nonagricultural sector. [17]

[16] Exportable products constitute a special case which will be discussed later. Their prices being set in the foreign market, they do not suffer drops.

[17] In this way, the self-control mechanism and the maximum degree of modernization are reached via the diffusion of modern methods. Reasoning in terms of the intensity degree, which is the second feature of modernization (see Section 2), the same result is obtained. The fall in traditional factor prices renders techniques using proportionately more of these factors economically more advantageous than modern techniques, thereby making farmers lose interest in adopting the latter.

Before discussing the economic validity of these inferences, the importance of the third proposition must be emphasized. The growth of the nonagricultural sector, in the sense of its capacity to absorb the additional agricultural output and rural labor surplus, becomes at a given point the principal restraint on the diffusion of the new technology. Although this proposition may at first seem unusual, it is supported by the following rationale:

> It is known that, as the economy develops, the income and employment shares of agriculture diminish; this is known as the "law of the declining relative importance of agriculture", or as the principle of "agricultural secular decline". [18]
>
> It is also known that this decline is due to a basic economic cause, the gap between the growth potential of agricultural output and the expansion possibilities of the effective demand for agricultural goods. The output potential of the agricultural sector has been increased thanks to higher productivity resulting from technological innovations — mechanical, chemical and biological. In contrast, consumption of agricultural goods has a relatively lower growth rate due to their low income and price elasticities of demand (Engels' Law) besides the increasing possibilities of substituting synthetic for natural products (fibers, leather, sugar, etc.). It is well-known that the demand for agricultural goods always increases less than that for industrial products and services.
>
> Thus, in a closed economy, economic development necessarily causes the agricultural output and labor force to decline relative to those of the nonagricultural sector so as to adjust to changes in demand curves and increases in productive capacity. It is generally accepted today that, as the agricultural sector makes progressive use of existing technological innovations, its labor force should decline from a high level of 70% to 80% of the total labor force to a very low level of 4% to 5%.

[18] Bruce Johnston makes the following statement concerning this decline: "One of the most firmly established empirical generalizations in economics relates to the secular decline of the agricultural population and labor force and agriculture's share in GNP in the course of economic development". "Agriculture and Structural Transformation in Developing Countries: A Survey of Research." *The Journal of Economic Literature* 8, no. 2 (June 1970): 369-404. See also W. H. Nicholls, "The Place of Agriculture in Ecolomic Development," in *Proceedings of an International Economic Association Round Table* (mimeo., Gamagori, Japan, April 1960).

It is recognized that in an open economy there should be no need, in theory, for such an intersectoral shift of labor. The additional agricultural production could be exported, while the increasing demand for nonagricultural products could be met through imports. In fact, however, the prospects for agricultural exports are always very limited as a result of the numerous restrictive measures imposed by all countries. For this reason, the agricultural labor force always diminishes, even in countries where development was initially based on agricultural exports; recent examples of this are Australia, Canada, and New Zealand. Therefore, it must be concluded that the diffusion of modern methods cannot proceed freely in agriculture. If the growth of agricultural production and the rural labor force is to some extent tied to the growth of the nonagricultural sector, then the diffusion of modernization, which gives rise to increased output and a declining labor force, is also dependent on the development of that sector.

The self-control mechanism and the maximum degree of modernization provide the bases for a hypothesis explaining how this dependence operates.

## 5 — THE SELF-CONTROL MECHANISM: DISCUSSION OF ITS ECONOMIC LOGIC

The system within which the self-control mechanism and the maximum degree of modernization operate is based on the following premises, which require certain qualifications:

the diffusion of modern techniques results in increased total output;
the drop in product price is followed by a drop in the relative prices of the traditional factors;
the fall in products and traditional factor prices acts as a counterincentive to further diffusion of modern techniques.

### 5.1 — Improved Techniques and Increased Production

Clearly, the production increase mentioned in the first proposition above will not occur if available resources in the sector are withdrawn or left idle. However, in agriculture such withdrawal is not simple. In developing countries, where a high

percentage of farmers operate at a very low technical level and have relatively few economic opportunities in nonagricultural sectors, less efficient producers are not easily forced out of the sector, as would happen in the industrial and commercial activities. [19] Most of the farmers, even the inefficient ones, prefer to remain in the sector, practicing subsistence farming and marketing only a small part of their output. The same occurs among underemployed farm workers. For lack of better opportunities, they prefer to become part-time workers or squatters in the interior of the country. In this way, they too make their small contribution to agricultural output. It can thus be assumed that in developing countries diffusion of technology always results in increased total output, thereby initiating the self-control process.

## 5.2 — Improved Techniques and Declining Prices of Traditional Factors

Consideration should be given to the fact that prices of the traditional factors might not diminish in areas undergoing modernization. In such areas, these prices might even rise due to increases in the marginal productivity of these factors. Prices would decline mainly in regions where modernization is more difficult either because of distance, unsuitable soil, or less skilled farmers. In such regions, land prices would fall unless noneconomic factors related to personal prestige, fear of inflation, etc., intervened. Wage rates could be similarly affected as a result of a decline in value of the marginal labor product. Thus, depending on elements such as local conditions and the mobility of labor, the diffusion of modern techniques may or may not affect traditional factors in areas where modernization is taking place. However, the effects described will surely occur in areas which have yet to be modernized, making the modernization process even less economically advantageous in such areas.

## 5.3 — Price Declines and Counterincentives to Diffusion of Modern Techniques

At first sight, it might appear that modern techniques resulting in significant increases in productivity and sharp reductions in

[19] It should be remembered that the self-control mechanism does not function in the case of industrial and commercial activities, precisely because inefficient producers and economically superfluous labor are more easily expelled from the market.

production cost [20] would be immune to the effect of the self-control mechanism. However, even these techniques are subject to the mechanism, as will be shown later using hypothetical examples.

For the purposes of the present analysis, modern techniques, in terms of increased productivity and reduced production costs, can be grouped in three classes:

- Modern Technique A – the increase in net financial return is due to a substantial increase in physical productivity, and not to a reduction in cost per unit of product; this generally occurs in the case of techniques requiring substantial fixed capital investments in tractors, agricultural machinery, mechanical harvesters, etc.;
- Modern Technique B – the higher return is due to increased productivity and to the reduced cost per unit of product; this is generally the case with techniques requiring little fixed capital investment, but a high degree of financing for fertilizers, pesticides, concentrated feed, etc.;
- Modern Technique C – the higher return is also due to higher productivity and reduced cost per unit of product, but does not require additional production expenses; such techniques include improved planting, proper spacing, adequate handling of pastures, use of better seeds, etc.

These techniques can be compared to traditional methods using the above expression (2), that is, the producers' net income in terms of production cost per unit of product:

$$NI^m = Q^m \left( P_q - \frac{P_x^m X^m}{Q^m} \right)$$

$$NI^t = Q^t \left( P_q - \frac{P_x^t X^t}{Q^t} \right)$$

Designating the expressions $\frac{P_x^m X^m}{Q^m}$ and $\frac{P_x^t X^t}{Q^t}$, representing costs per unit of product, $C^m$ and $C^t$, respectively, the difference in net income ($\Delta NI$) will be

$$\Delta NI = (Q^m P_q - Q^m C^m) - (Q^t P_q - Q^t C^t) \qquad (5)$$

[20] Production cost per unit of product, and productivity in terms of physical yield per unit of land.

Assuming the following values for a given traditional tecnique:

$Q^t$ = 800 units per hectare

$C^t$ = 16 *cruzeiros* per unit of output

$P_q$ = 20 *cruzeiros* per unit of output

the farmers's net income will be

$$NI = (800 \times 20) - (800 - 16) = 3\,200 \text{ } cruzeiros$$

Then let the following parameters be assumed for the three classes of modern techniques:

Technique A: $Q_a^m = 1.50\ Q^t$

$C_a^m = 1.05\ C^t$

Technique B: $Q_b^m = 1.25\ Q^t$

$C_b^m = .90\ C^t$

Technique C: $Q_c^m = 1.10\ Q^t$

$C_c^m = .90\ C^t$

With such assumptions, hypothetical examples can then be constructed to examine the effect of the self-control mechanism in relation to the diffusion of different techniques.

*Modern Techniques A*: In comparison to the traditional technique, the income difference favoring A will be

$$\Delta NI = [24\,000 - 20\,160] - [16\,000 - 12\,800] = 640 \text{ } cruzeiros/\text{ha}$$

Assuming this difference in income sufficient to encourage 20% of farmers to adopt the technique, there will be a 10% increase in their outputs. Further assuming the price elasticity of demand to be −.8, the product price will drop by 12.5% to 17.50 *cruzeiros*. With this change in product price, the income difference in favor of the modern technique will vanish:

$$\Delta NI = (21\,000 - 20\,160) - (14\,000 - 12\,800) = 360 \text{ } cruzeiros$$

It can be seen, therefore, that modern techniques with Class A features (in which increased productivity is followed by a small increase in production cost per unit of output — a relatively

frequent case in modernization)[21] are highly subject to the self-control mechanism. A drop in product price, without any change in traditional factor prices, is in itself sufficient to reverse the situation and bring diffusion to a halt. Consequently, the "maximum degree" of modernization with this class of technique is reached when only a small percentage of farmers modernize their activities.

*Modern Techniques B*: In comparison to the traditional technique, the increase in net income for these techniques will be

$$\Delta NI = (20\,000 - 14\,000) - (16\,000 - 12\,800) = 2\,400 \text{ } cruzeiros$$

Assuming this difference in income sufficient to induce 40% of farmers to adopt the technique, there will be a 10% increase in output. Assuming the same price elasticity as before, the

[21] In a previous article, I made a survey of several studies published by the Instituto de Economia Rural da Secretaria de Agricultura de São Paulo, comparing results obtained using techniques at different levels of modernization. These results were grouped in the table given below. Note that production cost reductions resulting from the use of the latest techniques were consistently high for coffee, ranging from −20% to −36%; for manioc, cost reductions were insignificant, being only −8%; for peanuts, there were wide variations, from −6% to −41%. Different results were observed for the other two products: potatoes showed sharp cost increases ranging from +12% to +48%, and corn showed both increases and decreases, from +16% to −4%. Such production cost increases do not mean that modern methods are less profitable than traditional methods, for it is possible that the larger harvests more than offset higher costs and consequently yielded higher profits to the farmers.

*Output and Cost Variations Due to Technical Changes, for Selected Crops in the State of São Paulo*[a]

| Crop | % Increase in Physical Output | | % Variation in Unit Production Cost |
|---|---|---|---|
| | Per ha | Per Man-Day | |
| Coffee | from + 100 to + 300 | from + 68 to + 143 | from − 20 to − 36 |
| Peanuts | from + 40 to + 178 | from + 8 to + 40 | from − 6 to − 41 |
| Manioc | + 100 | + 48 | − 8 |
| Corn | from + 14 to + 58 | from + 8 to + 308 | from + 16 to + 4 |
| Potatoes | from 0 to + 60 | from + 33 to + 124 | from + 48 to + 12 |

Source: R. Miller Paiva, "O Mecanismo de Autocontrole no Processo de Expansão da Melhoria da Agricultura." *Revista Brasileira de Economia* 22, n.º 3 (September 1968): 5-38. The number of cases and the period of observation vary from crop to crop. For further information, see source.

product price will be reduced by 12.5% to 17.50 *cruzeiros*. At this new price level, the advantage of the modern technique will be reduced to

$$(17\,500 - 14\,400) - (14\,000 - 12\,800) = 1\,900 \text{ } cruzeiros$$

Assuming that further diffusion occurs, enlisting an additional 20% of farmers, output will increase an additional 5% and price will drop 6.25% more. The difference in income favoring the modern technique will be further reduced, this time to 1 682 *cruzeiros*.

It can be seen, therefore, that class B techniques are less subject to the self-control mechanism. Despite reductions in product price, they continue to be more advantageous than traditional techniques. However, this advantage progressively declines in absolute terms and may eventually reach a level insufficient to cover the "subjective cost of transference".

With these techniques, the self-control mechanism acts mainly through reductions in traditional factor prices. Such reductions lower traditional technique production costs to a greater extent than modern technique costs, for the latter make proportionately less use of traditional factors.

This situation can be illustrated using the same hypothetical example. Assuming that reductions in traditional factor prices lead to a 10% decrease in traditional technique costs, the net income difference in favor of modernization will be lowered to only 402 *cruzeiros*. But reductions in factor prices causing a 15% decrease in costs will reverse the situation, so that the traditional technique will yield a higher income of 2 2448 versus 2 010 *cruzeiros* for the modern tecnnique, as shown below:

$$\Delta NI = (16\,410 - 14\,400) - (13\,128 - 10\,880) = -238 \text{ } cruzeiros$$

Thus, class B techniques reach an "adequate degree" at a higher level of modernization than class A techniques, that is, with a greater percentage of farmers modernizing their activities.

*Modern Techniques C*: Assuming the same values used in the preceding examples, this class will present the following income advantage in comparison to traditional techniques:

$$\Delta NI = (17\,600 - 12\,800) - [16\,000 - 12\,800] = 1\,600 \text{ } cruzeiros$$ [22]

22 In fact, using modern techniques, the cost per land unit should be slightly higher due to higher harvesting costs.

Diffusion of these techniques will bring about a lowering of the product price but will always insure a higher net income than traditional techniques. Furthermore, as costs are not increased, this advantage should remain unaffected even if diffusion causes reductions in traditional factor prices. For instance, if it is assumed that these prices drop to the extent of reducing total expenses by 10%, the same 1 600 *cruzeiro* advantage over traditional techniques will result:

$$\Delta NI = (17\,600 - 11\,520) - (16\,000 - 11\,520) \quad 1\,600 \text{ } cruzeiros$$

Therefore, class C techniques, which do not call for additional production costs, are the only ones not subject to the self-control mechanism.

However, they have a very limited role in underdeveloped countries because, as Schultz has shown,[23] such techniques do not provide large increases in productivity.

## 6 — THE SELF-CONTROL MECHANISM: THE CASE OF EXPORTABLE PRODUCTS

The self-control mechanism has only a partial effect on exportable products. Diffusion can take place without incurring reductions in product prices, since the demand curve for such products may be considered perfectly elastic for small exporting countries. Diffusion will affect only wage rates since the new techniques require less labor. Consequently, exportable products can attain a higher degree of modernization since modern techniques will become less advantageous, or disadvantageous, in relation to traditional techniques only in the event of a substantial decline in wage rates.

This can be shown using the hypothetical examples set up in the preceding section. For class A techniques, for instance, diffusion bringing about a reduction in wage rates which lowers production costs by only 5% eliminates the advantage of modern over traditional techniques. This advantage changes from 640 *cruzeiros* [(24 000 — 20 160) — (16 000 — 12 800)] to zero *cruzeiros* [(24 000 — 20 160) — (16 000 — 12 160)] when production costs are reduced by 5%.

In the case of class B techniques, a far greater reduction in costs is necessary to produce a reversal. With a 10% reduction, the

[23] *Transforming Traditional Agriculture.*

net income of 2 400 *cruzeiros* [(20 000 — 14 400) — (16 000 — 12 800)] in favor of modern techniques is reduced to 1 120 *cruzeiros* [(20 000 — 14 400) — (16 000 — 11 520)]. Costs would have to be reduced by 20% to produce a reversal, in which case the net income would be minus 160 *cruzeiros* [(20 000 — 14 400) (16 000 — 10 240)].

These examples show that export products are less subject to to the self-control mechanism as long as their prices are not reduced by increased output. Still, there is no doubt that modernization of these activities, by lowering wage rates, does intensify the effect of the self-control mechanism on nonexportable products. This is particularly true in the case of distant areas where conditions are not favorable to modernization due to transportation costs and marketing difficulties which result in unfavorable modern factor to product price ratios.

## 7 — MAXIMUM DEGREE OF AGRICULTURAL MODERNIZATION

It was shown that the self-control mechanism causes the diffusion of modern techniques to come to a halt, since product and traditional factor prices drop to a level at which the economic advantage of modern over traditional technology fails to offset the "subjective cost of transference". Yet it is not easy to determine the point at which this should occur, that is, to recognize the maximum "modernization degree" that the agricultural sector can attain.

In the preceding section, it was shown that, with regard to the diffusion of specific techniques, the maximum degree of modernization depended on the productivity increases and cost reductions per unit produced using these techniques (as compared to traditional ones) and also on the output price elasticity of demand. Hypothetical examples were used to show that with class A techniques the maximum degree of modernization is attained as soon as they are adopted by a small percentage of farmers. To reach the same point, class B techniques require adoption by a greater percentage of farmers; in addition, traditional factor prices have to decrease and changes have to occur in the relative production costs of the two techniques under comparison. Class C techniques are immune to the effects of the self-control mechanism, thereby permitting all farmers to adopt them.

Considering the agricultural sector as a whole, modernization assumes more complex aspects and cannot be represented merely in terms of the diffusion of a given technique. Farmers have a choice of a great number of techniques and products, and their adoption of these is neither steady nor equal. Some farmers become highly modernized, others modernize only in part, and still others remain completely traditional. Also, the percentage of farmers adopting each of these several techniques changes as modernization proceeds, and these percentages can be taken as measures of the overall modernization of the sector.

Despite this complex of techniques, products, and producers in different stages of modernization, the factors determining the maximum degree of modernization are basically the same as those for a specific technique, namely: cost reduction, productivity increase and output price elasticity of demand. However, to arrive at more precise notions regarding the maximum degree for the sector as a whole, it is necessary to use average values and a model which, though based on reality, is conveniently simplified.

Let us then assume a closed economy in which product and factor markets operate under perfect competition; in which technical assistance and financial services are sufficient to insure farmers complete freedom to choose the best techniques and products; and in which no changes occur in the shape of the demand curve as the population moves from the agricultural to the nonagricultural sector. In such an economy, the degree of modernization that can be attained will depend on the productivity level of the technology that can be adopted (state of arts) and on the percentage of the labor force engaged in agriculture.

The product to factor price ratios need not be considered here because the productivity level of the technology adopted and the price ratios are interdependent. That is, in equilibrium, one of these elements necessarily implies the other. For instance, if it is assumed that the labor productivity of modern techniques in relation to traditional ones is $5 \div 1.25$,[24] factor and product prices will remain at levels consistent with this productivity ratio and therefore need not be explicitly included in the model. If new productivity levels are assumed, the price ratios will implicitly change so as to adjust to these new levels.

[24] According to some authors, the productivity of modern techniques in relation to traditional ones is so high that, in a closed economy, output should be able to achieve equilibrium with only 5% of the labor force engaged in agriculture. Thus, a hypothesis assuming a productivity ratio of $20 \div 1$ could be formulated. However, for present purposes the ratio given is adequate.

According to this rationale, and assuming a productivity ratio of 5 ÷ 1.25, the degree of modernization as a function of the percentage of the labor force engaged in agriculture can be expressed as follows:

$$\alpha_m + \alpha_t = \alpha$$

$$5\,\alpha_m + 1.25\,\alpha_t = 100$$

that is: $5\alpha - 3.75\alpha_t = 100$

where: $\alpha$ = percentage of total labor force engaged in agriculture

$\alpha_m$ = percentage of agricultural labor force engaged in modern technique activities

$\alpha_t$ = percentage of agricultural labor force engaged in traditional technique activities.

Computing the values of $\alpha_t$ and $\alpha_m$ for different values of $\alpha$ gives the results shown in the following table:

| % of Labor Force in Agriculture | % of Labor Force in | | % Share of Modern Technique Activities in Agricultural Labor Force |
|---|---|---|---|
| | Traditional Technique Activities | Modern Technique Activities | |
| 80 | 80.0 | .0 | .0 |
| 70 | 66.7 | 3.3 | 4.7 |
| 60 | 53.3 | 6.7 | 11.2 |
| 50 | 40.0 | 10.0 | 20.0 |
| 40 | 26.7 | 13.3 | 33.2 |
| 30 | 13.3 | 16.7 | 55.6 |
| 20 | .0 | 20.0 | 100.0 |

The table indicates that the maximum degree of modernization can range from nihil to 100% depending on the percentage of the labor force engaged in agriculture. For example, an economy having 40% of its labor force in the agricultural sector could have a maximum of 33.2% of farm workers in modern activities (assuming, as established in the model, that these farmers produce more than traditional workers in a 5 ÷ 1.25 ratio).

It is important to observe that in this model the "maximum degree" of modernization is the same as the "optimum degree". This is so because, given an economy which operates under perfect competition, production and the degree of modernization will be in equilibrium at the same point that

producers' profits are maximized and factors (in terms of prices and marginal productivity) are thus optimally allocated.[25]

In principle, therefore, the degree of modernization cannot exceed this maximum. Thus, efforts would be wasted in intensifying and expanding technical and financial assistance services so as to induce a greater number of traditional farmers to modernize, for there would be no economic advantage in their changing techniques. With a given technology, only the growth of the nonagricultural sector would provide economic conditions for further modernization.

Nonetheless, by subsidizing the prices of modern inputs (tractors, fertilizers, pesticides, etc.), it is possible to achieve an "observed degree" of modernization higher than the "optimum degree". Subsidies encourage a larger number of farmers to modernize their activities, and thereby lead to higher output and lower prices, and a further stage in modernization. A new position of equilibrium is established, with a higher degree of modernization, but at the cost of less efficient allocation of factors in the agricultural sector. The results are increased total agricultural output, lower prices to the consumer, and higher net incomes for farmers who modernize. On the other hand, the incomes of all farmers who cannot modernize are reduced and agricultural wages decrease.

An observed degree higher than the optimum degree can also occur due to the appearance of a new and economically more productive technique resulting from an increase in experimental and research work or the importation of new technology.

Assuming that such new techniques, relative to the traditional ones, allow for an increase in total physical productivity in a $6 \div 1.25$ ratio, the optimum or maximum degree of modernization will be reached with 26.5% instead of 33.2% of the farmers adopting them, when the agricultural share in the labor force is 40%. Nevertheless, some farmers will continue to adopt the new techniques until changes in price ratios discourage other farmers from doing so. A new equilibrium will then be reached with an observed degree of modernization higher than the optimum, and this optimum will only be attained again when the nonagricultural sector absorbs part of the agricultural labor force.

On the other hand, the observed degree of modernization can also be lower than the optimum degree, if, for example, technical

[25] As this process is based on individual profit maximization decisions, the market mechanism automatically leads to optimum technology in private terms, but not necessarily in social terms. Since the following analyses concern a model under equilibrium, "optimum" will be used instead of "maximum", the values being equivalent in this case.

and financial assistance services prove inefficient. When this happens, factor allocation in the economy becomes less than optimally efficient, and product prices remain higher than they would otherwise, to the detriment of consumers and the economy in general.

With the aid of dummies such as the above, [26] it can be seen that once the maximum degree has been reached, modernization can continue at optimum rates only when the diffusion of modern technology is paralleled by a growth of the nonagricultural sector sufficient to absorb the additional output and labor surplus generated in the process.

Maximum and optimum degrees of modernization are useful concepts for formulating adequate agricultural policies in developing countries. Although it may be difficult to determine them empirically in a developing economy, it is important to recognize that there is a point in the modernization process beyond which further diffusion is no longer advantageous to the economy; it becomes dependent on expansion of the nonagricultural sector (and/or increased exports), which has to absorb the additional output and the labor surplus generated by the agricultural sector as a result of modernization. [27] Pushing modernization beyond the maximum degree, through specific measures such as subsidizing modern inputs, results in less efficient allocation in the agricultural sector. Even though consumers may benefit from lower food and raw material prices, wage rates and farmers' net incomes are reduced where agriculture has not been modernized. Furthermore, an undesirable population shift to urban areas occurs — that is, on a scale that cannot be absorbed productively.

[26] This model can also be used to examine the effects of exports on modernization degrees. The amount exported would be considered simply as an increase in aggregate demand. Assuming a 20% increase in export production, maximum degrees of modernization could be calculated using the following equation:

$$5\,\alpha - 3.75\,\alpha_t = 120$$

In this case, with an agricultural labor force of 50%, the maximum degrees of modernization would rise from 20% to 30.5%. 100% modernization would be achieved when the agricultural labor force dropped to 24%. Therefore, by increasing exports it would be possible to raise the modernization degree in the agricultural sector.

[27] It is clear that in comparing possible changes in technological levels and the price elasticities of demand for these products, the possibility of reducing marketing costs and transferring any resulting benefits to consumers must also be considered. Thus, production and consumption might be increased to a certain extent without the need to reduce prices received by producers.

Although it is difficult to make a rigorous and empirical determination of the maximum degree of modernization of an economy, some useful conclusions can be drawn. Considering, for example, a package of modern techniques being applied to the major products of a region, it is possible to compute their average costs and physical productivities as compared to the traditional techniques they substitute, as well as the price elasticity of demand for the goods involved. These figures can then be used to calculate the additional output which the market will have to absorb at prices that are lower but still profitable for producers who have modernized. Based on productivity in physical terms, it is then possible to calculate the number of farmers (or hectares) that will be able to adopt these modern techniques economically. This approach provides a satisfactory estimate of the maximum degree of modernization with a given set of techniques. It is also possible to calculate the effects of further diffusion of these techniques, together with reductions in product prices and wage rates, and to estimate the corresponding costs and benefits of such a modernization process.

## 8 — MAXIMUM DEGREE OF MODERNIZATION: SELECTED CASES

It should be observed that degrees of modernization differ widely from product to product. For some, practically all producers use modern techniques, traditional methods being uneconomic. For others, nearly all employ traditional methods, modern techniques being uneconomic. The majority, however, are produced under a technological dualism, with both modern and traditional techniques, in varying proportions according to the product.

It is important to clarify that the existence of products all of whose producers are modern does not contradict the statement made previously that the diffusion of agricultural modernization is limited by the self-control mechanism. No contradiction exists because the discussion concerns individual products, whereas the preceding analysis applies to agriculture in general. When only a few activities are being modernized, the sef-control mechanism exerts only a partial effect. The reason is that as the number of producers using modern techniques increases and the product market price declines, inefficient (mainly traditional) producers shift to other agricultural products not requiring modernization. This shift from one product to another temporarily postpones

reductions in the prices of traditional factors and thereby limits the effects of the self-control mechanism.

Once modernization extends to all products, the possibility of shifting from modern to traditional activities is eliminated. The only way that a drop in labor prices (and therefore the full effects of the self-control mechanism) could be avoided would be to transfer inefficient farmers and the labor surplus to the nonagricultural sector.

When individual products are considered, the maximum degree of modernization also depends on the relative increases in physical productivity, the relative decreases in costs per unit produced, and the price elasticity of demand for the product. The maximum degree is reached when all traditional farmers whose expected profit exceeds their subjective cost of transference adopt modern techniques.

There is no empirical data available for formulating numerical examples of maximum degrees of modernization for different products. However, based on personal knowledge of how yield and cost behave in the production of certain agricultural goods to which modern and traditional techniques are applied in the South region of Brazil, the author established hypothetical supply curves for selected products under different technologies and compared them with the respective demand curves. In this way, it was possible to determine the maximum degree of modernization at a given moment based on the shares of modern and traditional farming in the total supply.

The products discussed below illustrate the three cases mentioned above, that is, where the product is supplied: (1) only by modern farmers, (2) only by traditional farmers, and (3) by both types in varying proportions.

In the figures which illustrate these cases, the curves labeled $S^t$ represent the supply obtained using traditional techniques, and those labeled $S^m$ the supply obtained using modern techniques.

*Figs, Grapes and Peaches*: The supply curves for these fruits are assumed to be those shown in Figure 2. It is known that modern techniques (using selected varieties, fertilizers, disease prevention and pesticides) provide these crops with high levels of physical productivity. For this reason, the supply curve ($S^mS^m$) tends to remain at low levels, and modern farming provides the entire quantity consumed (Oa) at the price level (Pr).

Using traditional technology, productivity would be very low since in Brazil these fruits are extremely susceptible to diseases, pests, poorly cultivated soil, and so on. Because of this,

the supply curve of traditional farming (were there any producers) would be very high ($S^tS^t$), so that production using this technology would be uneconomic. Thus, these fruits present the extreme instance of a high degree of modernization with practically the entire output (Oa) resulting from modern technology farming.

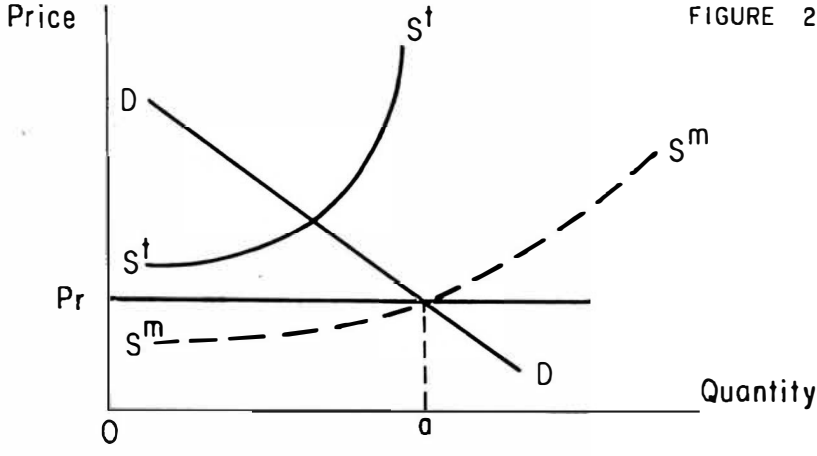


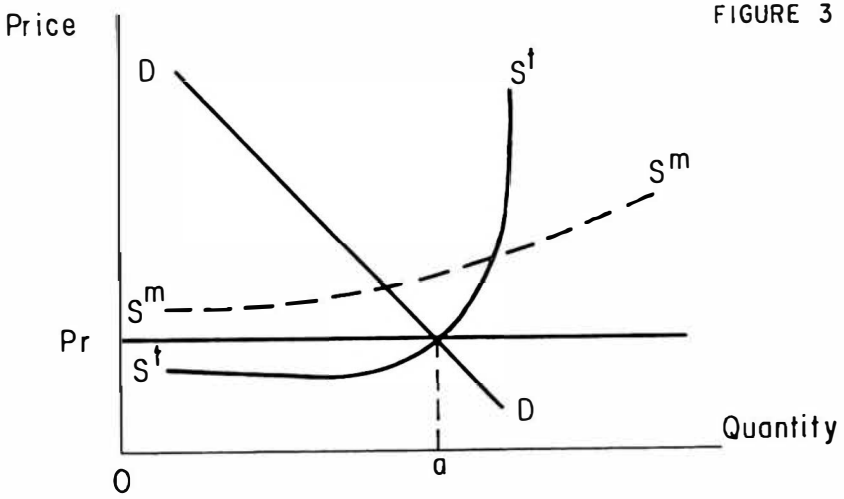

FIGURE 2

*Manioc*: This product illustrates the opposite situation, and it is assumed that its supply curves are those shown in Figure 3. Traditional farming has a marginal cost curve ($S^tS^t$) which is initially extremely elastic. This is due to the abundance of suitable soils and weather conditions for this crop all over the country. Physical productivity is reasonably satisfactory as the crop is not subject to serious diseases or pests and is resistant to climatic changes. Its supply curve would become inelastic only if the country demanded that a much larger volume be produced.[28]

In this case, adoption of known modern techniques does not produce a significant increase in productivity because little research has been done on this crop. For this reason, the supply curve of modern farming will probably tend to lie above the

[28] This feature of the traditional agriculture supply cost curve (high elasticity followed by high inelasticity) is due to its dependence on land and labor, which, in Brazil, are abundant factors given the demand for agricultural products. For this reason, the supply of a given product can increase initially without raising prices. However, with the continuing growth of production, a point is reached at which these factors are fully employed.

FIGURE 3




price line, which is established at the level where the traditional supply curve crosses the demand curve. Thus, this product provides a typical example of a crop produced almost exclusively using traditional methods.

*Corn, Poultry, Eggs and other Products*: These products are examples of the use of dual technology, the market being supplied by modern as well as traditional farmers. The reason is that the cost differences are not very significant. In the case of poultry and eggs, for instance, the cost curve for traditional technology should begin at a low level as compared to the modern technology curve, but soon experience a sudden change in elasticity. The explanation is that low costs can be maintained for small-scale poultry and egg production because of the limited number of fowl. When the number increases, pests and diseases become serious problems and may cause substantial losses.

Modern technology for poultry and egg production has made great advances and productivity has been substantially increased. Consequently, the production cost using modern techniques is relatively low and satisfactorily elastic, and modern activities account for a substantial percentage of the market supply, shown as (Oa) in Figure 4. Even so, the output of small-scale "backyard" traditional producers finds its way to the market (Ob). [29]

[29] In Figure 4, only the market price level is included. The demand curve has been omitted because it would have to cut the joint curve for the two supply curves to determine the price, which would complicate the figure unnecessarily.

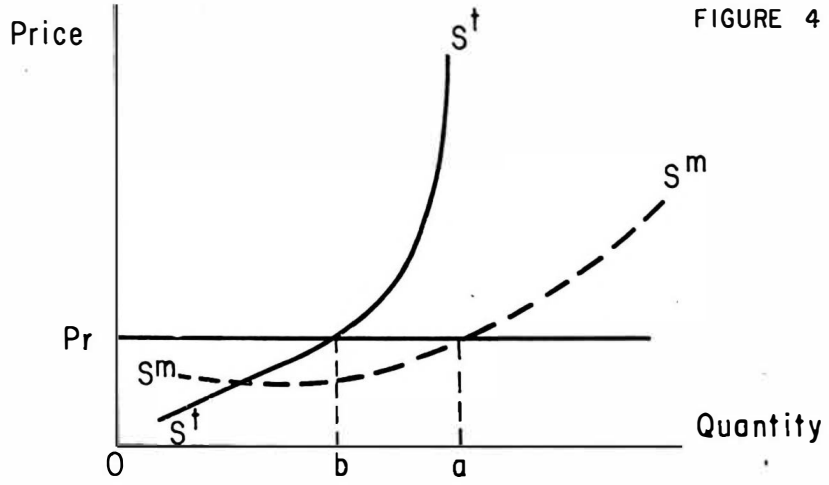



FIGURE 4

Corn illustrates the opposite situation. Figure 5 shows that the quantity supplied by traditional farms (Ob) is larger than that provided by modern farms (Oa). The reason is that corn can be grown in many regions in Brazil and is not subject to pests and diseases to a significant extent. Moreover, the traditional varieties are fully adapted to the soils and climates of the regions where they are grown.

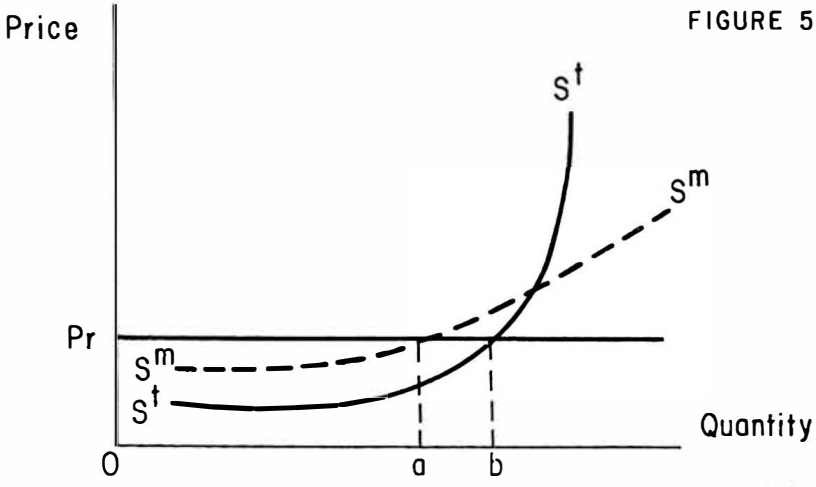



FIGURE 5

With modern technology (particularly with the use of hybrid seeds, fertilizer and machines), higher physical productivity can be obtained, but the effect on the supply curve is not yet very favorable. For this reason, few farmers have adopted modern techniques.

## 9 — SUMMARY OF CONCLUSIONS AND IMPLICATIONS FOR AGRICULTURAL POLICY

In this analysis of the process of agricultural modernization, a number of conclusions have been drawn that are of significance for the development of agriculture. These can be summarized as follows:

- The diffusion of modern techniques among a greater number of farmers does not depend only on generally recognized factors such as technical knowledge, availability of resources and favorable prices ratios; it is also limited by the development of the nonagricultural sector.
- There is a "self-control mechanism" which operates through fluctuations in product and traditional factor prices and prevents diffusion beyond a certain limit which might be termed the "maximum degree of modernization".
- When modernization is pushed beyond this "maximum degree", it leads to greater losses for traditional producers and wage-earners and an undesirable flow of labor force to urban centers.
- The modernization process comprises the use of various techniques, each having different effects according to the limits established by the self-control mechanism; only the use of techniques not calling for additional capital expenditures are exempt from the bounds set by this mechanism.
- As more productive techniques become available, more farmers adopt them; as a result, the "observed degree" of modernization rises above the maximum degree, making conditions more difficult for farmers who are unable to modernize and for wage-earners.
- Raising the maximum degree of modernization without placing wage-earners and those who maintain traditional methods at a further disadvantage depends on the growth of the nonagricultural sector and/or export sector.

- If the nonagricultural sector does not develop sufficiently, it will not be possible for all farmers to modernize their activities; consequently, some farmers will have to continue using traditional methods until the nonagricultural (and/or export) sector develops further or until they have an opportunity to transfer to another sector.
- The coexistence of traditional and modern agriculture, i.e. economic dualism, is a feature inherent to the process of agricultural development and does not reflect *only* differences between farmers or regions or the inefficiency of technical and financial assistance services.

The existence in the modernization process of a self-control mechanism which sets a maximum degree for the diffusion of modern techniques has two highly significant implications for the formulation of agricultural policies.

The first is the need to establish special assistance programs for farmers who are unable to modernize their activities. The aim of such services is to help them adopt more productive modern techniques under better conditions.

In developing countries, governments try to make these services available to all farmers without any intentional discrimination. Occasionally, special assistance programs are also provided for farmers located in areas where modernization is not feasible until it is possible to relocate them to areas where more productive farming is economically feasible.

However, despite such programs, our conclusions indicate that a certain percentage of farmers have to wait for the nonagricultural sector and exports to expand before they can modernize their activities.

Some of these farmers are still able to maintain reasonable income levels either because of the high quality or the quantity of their land endowments. The majority, however, continue to be traditional low-income farmers. A special assistance service should be established for training these farmers in the use of improved techniques which do not require additional capital and to show them how to improve their housing, health, nutrition and social conditions using available local resources. Such special programs would be one way of providing these farmers with additional income in real terms, since it is not possible to do so in financial terms.

It is obviously not easy to obtain positive results with this type of program. Farmers who are used to responding only to the

incentives of higher prices and wages cannot be easily induced to make additional efforts in the way suggested. Furthermore, in being encouraged to adopt a more self-sufficient way of life, it may seem that they are being asked to regress, not progress, economically. Because of the self-control mechanism, however, there is no other way to improve the living conditions of less favored farmers. Such a program could provide a certain measure of relief from difficult living conditions until the general economic development of the country makes it possible to spread throughout the agricultural sector the benefits of more productive technology and higher net financial incomes.

The wages and living conditions of agricultural workers pose a similar problem. An increase in the productivity of the marginal worker (higher wages) can only come about once modernization reaches practically the whole agricultural sector. This can happen only in a more distant future since diffusion is tied by the self-control mechanism to the development of the nonagricultural sector. Moreover, economic development is not in itself a rapid process.

The alternative is to improve the living conditions and real incomes of farm workers without necessarily increasing their monetary wages. This could be done, as in the case of farmers, by means of a special assistance service designed to promote cooperation between farmers and workers in seeking better living conditions without additional cash expenditures. This, too, would be a difficult program to implement, but it is a possibility in a market economy.

The second implication concerns the role of agriculture in economic development. The self-control mechanism imposes a maximum degree of modernization on agriculture and thereby prevents this sector from maintaining its dynamic role in the development process. Once this degree is attained, new techniques are adopted by a relatively small number of farmers. Furthermore, the additional income generated by these new techniques is limited, since only the farmers who modernize first receive the benefit of additional net income, and even so only for as long as product prices do not decline. It is true, however, that the drop in retail food and raw material prices resulting from these new techniques is an added dynamic factor, for the income thus saved increases the demand for, and consequently the production of, other items in the nonagricultural sector. Nevertheless, these increases in income are partly offset by reductions in the net incomes of those farmers unable to adopt new techniques, so that the overall net income is less than it would be otherwise.

As for exportable products, the use of new technology generates a greater volume of income, since the self-control mechanism has only a partial effect on these activities. Therefore a higher degree of modernization can be achieved in this case.

Thus, the capacity of the agricultural sector to stimulate the national economy by generating a large volume of additional income is restricted. Such additional income would demand higher output from other sectors, which, in turn, would require higher output and a greater degree of modernization in the agricultural sector in a self-sustaining growth process. But agriculture is an induced sector, responding only to demands for additional output and higher productivity coming from outside the sector. As an induced sector of development, the performance of agriculture must be evaluated in terms of how promptly and in what way it responds to demand increases and to the economic requirements of changes in technology.

## 10 — THE CASE OF THE DRY REGIONS OF THE BRAZILIAN NORTHEAST

The self-control mechanism in modernization makes the solution of agricultural problems in the dry regions of the Brazilian Northeast particularly difficult.[30]

Low-fertility soils and poor distribution of rainfall are typical of these regions. Periodic severe droughts force their inhabitants to migrate to distant areas in search of water, food and work. The population density is high relative to available resources. The agrarian structure is characterized by medium and large-scale establishments and by the great proportion of wage-earners, share-croppers and farm-hands in the labor force. There are also a great many small farms of a size insufficient to support even the farmers' families. Methods of production are generally very primitive. Financial returns are always very low, as are wages, and there are few employment opportunities.

Modern agricultural knowledge is restricted to a few experimental stations and to the personal knowledge of a few more capable farmers and extensionists in the area.

30 The following discussion is largely based on research conducted by Nicholls and Paiva. In addition to other publications related to this research, see W. H. Nicholls and R. Miller Paiva, *Ninety-nine Fazendas: The Structure and Productivity of Brazilian Agriculture* (Nashville: The Graduate Center for Latin American Studies, Vanderbilt University, 1963); and W. H. Nicholls, "Ninety-nine Fazendas Revisited: Some Preliminary Observations on Major Changes in Brazilian Agriculture, 1963-1973" (to be published).

Despite all these factors, the region's agricultural and livestock production and vegetable extraction are considerable. Statistics indicate that food imports are slight, while exports, both to other regions and abroad, of goods such as cotton, sisal, castor oil seeds, waxes and oils areas consistently high.

All this would suggest that the solution to the agricultural problems of the Northeast would be to modernize production, expand research, improve technical and financial assistance services and improve markets and marketing procedures. This would result in higher production yields and profits for farmers, who would then be able to pay higher wages.

However, as already seen in developing countries, modernization could not reach a great proportion of farmers even if material resources and efficient technical knowledge were available and farmers were willing to adopt modern methods. Only a limited number of farmers will be able to adopt modern techniques economically. The remainder, either because they are less skilled or because they are located in unsuitable areas, will have to await further development of the nonagricultural sector. This delay involves sacrifices, for modernization increases output and lowers prices, thereby worsening conditions for those who have not modernized their activities.[31]

In Brazil, modernization is being diffused more intensively and rapidly in the South and Southeast regions, where climate and soil are more favorable for agriculture, with the added advantages of the proximity of large urban industrial centers. This makes it still more difficult to modernize the agriculture of the Northeast, particularly in the case of goods produced for the domestic market, where the self-control mechanism more readily imposes price reductions. It is true that for some of these products modern techniques are definitely economically superior to traditional methods: poultry and eggs, certain fruits, vegetables, etc. The production of such goods could be fully modernized, but the local market for them is very limited and only a few producers would need to modernize their activities to insure a full supply. The modernization of these production activities, therefore, is not sufficient to bring about a widespread improvement in the region's agriculture.

*Modernization of the Farming of Exportable Products*: More extensive modernization of agriculture in the Northeast would have to depend on export products which are not greatly

31 See T. W. Schultz, "A Policy for Redistributing Losses from Economic Progress," *The Journal of Farm Economics* 43 (August 1961): 554-65.

affected by the self-control mechanism. These products would allow a greater percentage of farmers in the region to modernize their farming processes.

Nevertheless, it should be remembered that many of the farmers who today produce for export will be unable to adopt modern techniques economically, for they are located where the soil is very poor and the land is far from level. On such terrain, fertilizers are not very effective and machines cannot be used.

There is no information available concerning the number of farmers who are poorly located and who therefore could not modernize even if technical and financial assistance services were improved. However, there is reason to believe that their number is substantial. The solution might be to relocate them to areas more suited to modern technology, but to do this in an organized and efficient manner would be extremely difficult. Now that the Amazon Region is being opened, prospects are more promising. This opportunity for relocating some of the farmers of the Northeast should not be lost.

*Nonconventional Assistance:* If it is not possible to provide conditions conducive to modernization and resulting in higher incomes for these farmers, is is necessary to find some other way of helping them while they wait for the nonagricultural sector to develop sufficiently to be able to absorb them economically.

In a previous section, the possibility of assisting these farmers in improving their standard of living was considered. This would provide them with higher income in real terms, without changing their monetary income. Such a program would require the establishment of a noncoventional technical assistance service which would teach them how to improve their housing, health, nutrition and communal activities by making use of available local resources. At the same time, they would be counseled on the use of modern techniques which do not call for additional capital expenditures.

The above solution might be criticized on the grounds that it advocates stagnation rather than progress. There is truth in this but in the absence of a better alternative, it could minimize the difficulties experienced by the farmers while waiting for new opportunities in the nonagricultural sector.

Both this special kind of assistance and the relocation of farmers should be supplemented by the other assistance programs which have been recommended for the region: irrigation projects where economically feasible, crop insurance against droughts,

economic feasibility research on the use of *cerrado* vegetables, and so on.

*Rural Labor Conditions*: Other particularly difficult problems in the Northeast are agricultural workers' wages and standards of living. In principle, modernization and marginal labor productivity increases should raise wage rates. However, 40% to 50% of the country's labor force is engaged in agriculture, and a relatively small percentage of agricultural establishments use modern processes of production. As a result, marginal productivity and consequently wages are very low, which is consistent with the low productivity of traditional agriculture. Furthermore, there is little prospect of improving this situation in the near future, because diffusion of modernization beyond its maximum degree can only occur once the resulting additional output and labor surplus can be absorbed by expanding nonagricultural and export sectors.

Within this context, it is clear that land reform programs, in the sense of better distribution of land in the Northeast, would have a limited effect since the income to be redistributed is very small. Only in some areas having idle and fertile land would such reform yield benefits resulting in increases in production, employment and income.

In view of the impossibility of resolving in the near future the problems of low wages and standards of living on a strictly economic basis, some indirect solution must be found. This might be along lines similar to those suggested for farmers who are unable to modernize their activities, and would involve providing rural workers with better living and housing conditions, as well as better means for subsistence farming. Most of this could be achieved without any additional financial expenditures, using only available local resources. However, the success of such a program would ultimately depend on the joint efforts of landowners, workers and government on a large-scale and at a high level of motivation.

*Subsidizing Cotton Production*: Exportable products, particularly cotton, could be subsidized to encourage modernization. Guaranteed higher product prices and lower modern input prices, as well as crop insurance against losses from weather, could be offered. Such subsidies would encourage farmers to modernize their activities and consequently raise production, income and employment levels in the region.

Prices could be only partly subsidized through tax reductions, including exchange rate reductions. Moreover, judging from price

conditions in the Northeast, an export price subsidy would also be needed to induce farmers to invest in modernization, at least during the first years of the program.

This direct subsidy would have to be paid out of government funds. However, since the Northeast is a problem region receiving substantial financial assistance from the government, it is reasonable to assume that part of these funds could be appropriated to finance the subsidy program, particularly since this is the only way to achieve a rapid increase in productivity.

The program could be established along the following lines:

> the implementing agency would establish regions where the sale of seeds for planting would be under its sole control (following the example set by the Department of Agriculture of the State of São Paulo);
>
> farmers planning to modernize production would sign contracts with this agency under which they would receive a price subsidy and insurance in return for committing themselves to adopting the techniques recommended by the agency (following the example of cooperative fields);
>
> machinery for processing cotton would be rented to farmers by the agency, and the product would be sold by it in standard lots to exporters and to Brazilian industry.

Price subsidies are rarely economically advantageous in developing countries. Still, it is quite possible that subsidizing cotton in the Northeast would turn out to be a successful policy, and that modernization of cotton production would in fact continue to expand throughout the region after the subsidies were withdrawn. Thus, a system of subsidies on a declining scale might be adopted for this program.

There are a number of reasons for this promising outlook. One is that there is a distinct possibility of raising the price of Northeastern cotton to a more favorable level. The quality of Northeastern cotton fiber, particularly the long-fiber *mocó* variety, is generally recognized to be very high. However, the lack of standard grading of the cotton sold on the domestic and foreign markets has kept prices at relatively low levels. Once control were established over seed sales, standardization and improved quality would become feasible. Standardization would lead to a consistently high-grade product and consequently guarantee better export prices.

Another reason for optimism is the possibility that the increased profits derived from modernized farms would be sufficiently high

to interest other farmers in adopting modern techniques, even after subsidies were reduced.

Another advantage to such a program is that it could be implemented on different scales according to the funds previously allocated for it. The size of the areas and the number of cooperating farmers could be established so as to avoid incurring excessive risks. Furthermore, since there are guaranteed export markets for cotton, there would be no danger of the subsidy initiating the cycle of increasing production and falling prices which would make the program increasingly costly.

# THE TRAINING OF THE INDUSTRIAL LABOR FORCE IN BRAZIL *

*Claudio de Moura Castro*

## 1 — INTRODUCTION

### 1.1 — Purposes of the Present Paper

The original purpose of the research undertaken was to study alternative modes of educating or training labor for the Brazilian manufacturing sector. The idea was to compare alternative ways of preparing industrial labor — specifically, conventional academic schooling, vocational training, technical schooling and on-the-job training. Earning functions were examined for various combinations of formal schooling and on-the-job training. Although most of the analysis was conducted by comparing the shape and position of age-income profiles, rates of return were also computed in order to facilitate comparisons.

Eventually, the scope of the analysis was broadened to include other dimensions of the manpower problem. The attitudes and expectations of workers and students were carefully examined not only in technical and vocational schools, but also in the regular academic programs, including elementary schools. Preferences for occupations and prejudices against blue-collar occupations were explored.

Substantial space was devoted to the analysis of three categories of mobility of the blue-collar labor force: intergenerational, vertical and horizontal. "Intergenerational mobility" reflects the changes in occupational and social position

* This paper summarizes the research report by C. Moura Castro e A. Mello e Souza entitled *Mão-de-Obra Industrial no Brasil: Mobilidade, Treinamento e Produtividade*, Relatório de Pesquisa, n.º 25 (Rio de Janeiro: IPEA/INPES, 1974). This report is a study of the industrial labor force and its training in São Paulo and Rio de Janeiro, the most industrialized states in Brazil.

between fathers and sons. By "horizontal mobility" we mean the changes in the occupation held by the worker — for example, a carpenter becoming a machinist. What we have termed "vertical mobility" concerns the career paths of the workers. There is a wide range of occupations and income levels within the blue-collar world. What factors account for the distribution of workers among these positions? The nature of the training received may or may not coincide with the occupation subsequently held. What degree of congruence is there between training and occupation? How difficult or how easy is it to adapt to different occupations? How specializing is specialized training? Careful examination of the available evidence permitted us to destroy some myths and formulate some intriguing hypotheses.

## 1.2 — The Data Basis

Two sources of information were utilized in this research. We had access to a survey conducted by the University of São Paulo. In this survey, about 700 firms were examined in a stratified sample representative of the manufacturing sector in that state. Workers exercising some supervisory control or occupying higher positions on the technical staff were interviewed. However, only data on blue-collar workers were used for this research, administrative staff and management being excluded.

Though large and representative, this sample presented a relatively limited vector of information on the individual worker. We therefore conducted a second survey in Rio de Janeiro to complement these data. In the second survey we sought to gather the information that had been missed in the first. We were willing to limit the number of occupations examined in order to have enough observations for each. In addition, we needed a sufficient number of observations for each educational and vocational path leading to that occupation. We also wanted a sample in which a large proportion of workers had been in vocational programs. Our strategy was therefore to choose five of the largest industrial firms in the city of Rio de Janeiro.[1] To obtain permission to interview workers represents a heavy fixed cost in terms of time. Consequently, we preferred a small number of firms with many skilled workers on their payrolls. Also, larger

1 The area presently occupied by the city of Rio de Janeiro corresponds to that of the former state of Guanabara, which was recently integrated by law to the already existing state of Rio de Janeiro. Thus, for comparison to previous data, what we here term Rio de Janeiro must be understood as the state of Guanabara.

firms offer the further advantage of operating their own training programs, which could be carefully examined. No attempt was made to cover all areas of the manufacturing sector: two firms are in the electrical-mechanical sector, one is a large shipyard, one the maintenance shop of an air transportation company, and one the repair shop of a railroad company. Hence, the sample is not representative of the manufacturing sector and has a strong bias towards the large firms. On the other hand, since the questionnaires were carefully controlled, the data can be considered highly reliable. Also, and of no less importance, a very detailed questionnaire was distributed to all the blue-collar workers (skilled and unskilled) in the plants.

The two sets of data are highly complementary. Whereas one sample is large and representative of the manufacturing sector in São Paulo, the other is smaller (5 000 observations), includes only large firms and could not be considered even remotely representative of that sector in Rio. But it did permit a good examination of a few selected occupations by means of a detailed and carefully applied questionnaire.

Also worth mentioning is a small survey conducted in Rio de Janeiro among fourth-grade elementary students in schools located in the industrial neighbourhoods. An official vocational training entrance examination, in addition to an aptitude and educational expectations questionnaire, was given to approximately 300 students.

## 1.3 — Structure of the Brazilian Educational System [2]

Figure 1 depicts the formal structure of Brazilian education. [3] In order to simplify the graphic presentation, nonformal education has been excluded. In this category would be included a great variety of courses covering a broad range of subjects. Although these constitute an important part of the educational structure of the country, they are not accredited courses, nor do they fulfil prerequisites for admission to the schooling system. Among these

[2] According to an act passed in 1971, the system described in this section was to be superseded by a new structure. We chose to describe the old system because it was the one in force, legally and effectively, at the time the present research was being conducted. Furthermore, even now the conversion is far from complete.

[3] Whereas what is termed "fundamental education" previously had a legal duration of four years, it lasts seven years under the newly adopted system. Also, there has been a somewhat faltering effort to add vocational subjects to the high school curricula.

could be included language courses, correspondence schools, preparatory courses, etc.

The white boxes indicate academic schooling, whether liberal education or preparation for further studies. The gray boxes indicate professional, vocational or technical training.

Some courses provide vocational training without losing their academic character, meaning that they offer possible access to the higher rungs of the educational structure. In Figure 1 such courses are shown by the half-gray boxes. Arrows indicate the access paths between different courses. SENAC and SENAI programs [4] do not formally require *ginásio,* though preference is sometimes given to candidates having this level of education in some careers in greater demand. The dotted line shows this path.

Elementary education is a prerequisite for all the other courses considered here. In addition, the only way of access to the *colégio* level (i.e., *clássico, científico, normal,* and *técnico*) is *ginásio,* be it the strictly academic program, the *ginásio orientado para o trabalho — GOT* (comprehensive), or the *ginásio industrial.*

At the *colégio* level, not only the humanities and scientific programs, but also the technical schools, normal schools and military academies, allow access to the universities. However, this access should be considered no more than a legal possibility, for each type of school maintains its own quality standards and caters to a clientele having specific abilities. University entrance examination scores emphatically reflect such differences.

The figure does not include *Artigo 99,* which is an accreditation exam allowing adults to obtain *ginásio* and *colégio* diplomas by examination.

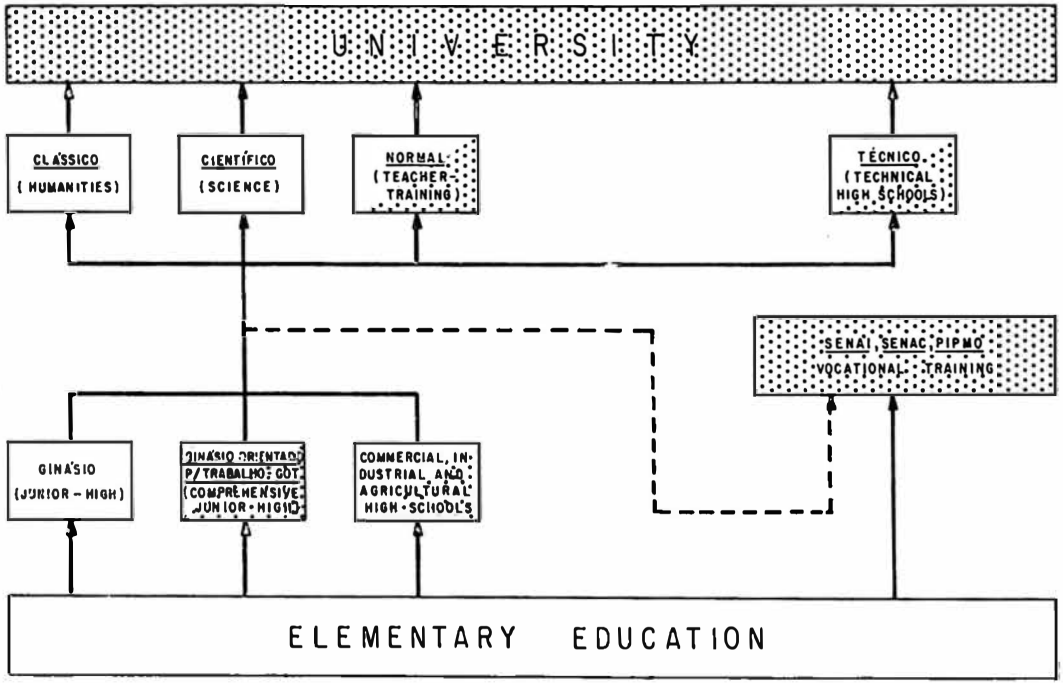
SENAI, SENAC and PIPMO[5] are not an integral part of the Brazilian formal education system, though they do offer self-contained vocational training. SENAI operates not only the standard vocational schools, but also programs within firms. From the administrative point of view, this is arranged through agreements by which the firms, in exchange for bearing the costs of the programs, are allowed a reduction in their compulsory contribution to SENAI.

4 SENAC (Serviço Nacional da Aprendizagem Comercial) is the official nation-wide vocational training system for workers in commerce and allied services. SENAI (Serviço Nacional da Aprendizagem Industrial) is the official nation-wide vocational training system for industrial workers.

5 PIPMO (Programa Intensivo de Preparação de Mão-de-Obra) is the official nation-wide intensive program for the training of manpower.

FIGURE 1

## STRUCTURE OF THE BRAZILIAN EDUCATIONAL SYSTEM



SENAC has an administrative structure similar to that of SENAI. It operates vocational schools for adults and minors. On-the-job training is offered in shops, hotels, restaurants, and other concerns established and managed by SENAC itself.

In terms of pedagogical format, PIPMO is very similar to SENAI, the main difference being the more intensive nature of its courses and the fact that it trains and retrains only adults, while SENAI also prepares minors. In point of fact, whether priority should be given to juveniles or adults in vocational training remains an open question. PIPMO does not not operate training programs directly; instead, it finances already existing institutions, contracting work with foundations, charity institutions and even SENAI.

## 1.4 — Financial Structure of the Brazilian Educational System

Figure 2 shows in a simplified manner the financial structure of the Brazilian educational system according to the source of the *funds*.

The elementary level shows the greatest variety of sources, being financed by the families of the students (private schools), governments (state and municipal), firms (through a compulsory contribution called *Salário Educação*), foundations and charity institutions.

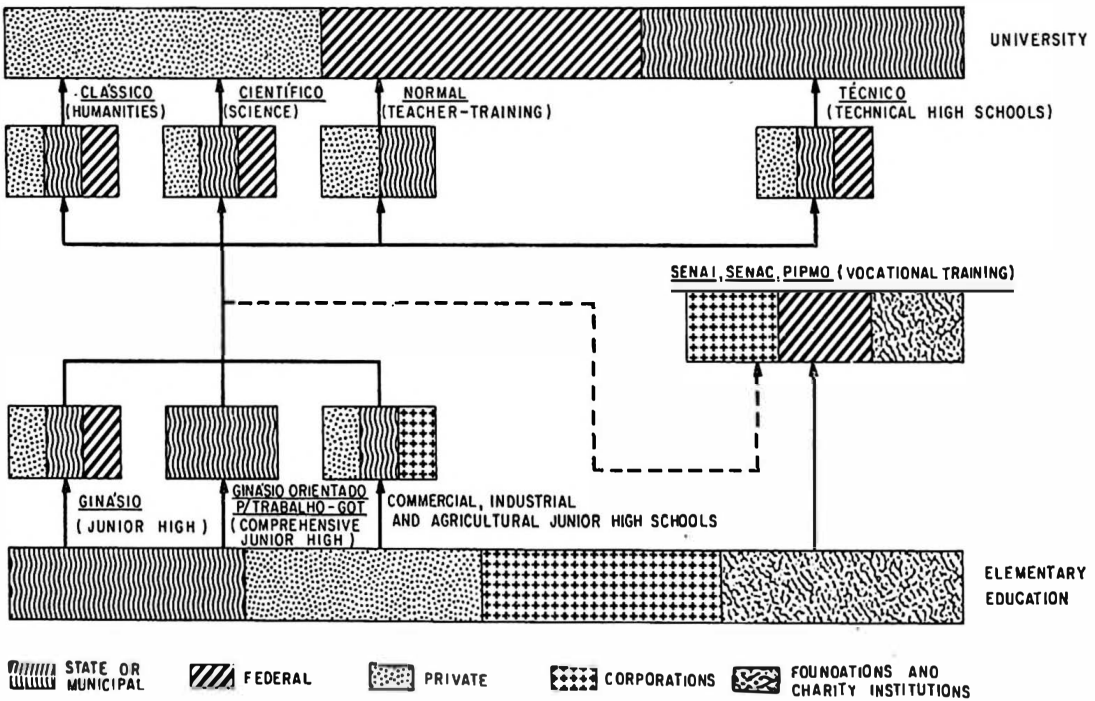
Conventional *ginásio* (junior high schools) are private or state-sponsored, though the federal government still operates some schools. The *ginásios orientados para o trabalho — GOT* (comprehensive junior high schools) are nearly always supported and operated by state governments. The *clássico* and *científico* programs at the *colégio* level have roughly the same structure as the conventional *ginásio*.

Teacher-training (*normal*) and accounting (*técnico*) schools are private or state-operated. Industrial technical schools (*técnico*) are mostly supported and operated by the Ministry of Education, though there are a number of private technical schools as well. The military academies are maintained by the respective military ministries.

The most important Brazilian universities are operated by the federal government. However, there is a large and rapidly growing number of private universities, and some of the best are subsidized by the government. The number of universities sponsored by the state governments is very limited.

FIGURE 2

## FINANCIAL STRUCTURE OF THE BRAZILIAN EDUCATIONAL SYSTEM



SENAI operates under the responsibility of the Federações das Indústrias (the official industrial employers' unions) which, in turn, are coordinated by the Confederação Nacional das Indústrias. SENAC functions in a similar manner, but under the responsibility of the Federações and Confederação do Comércio (the official employers' unions for commerce and allied services)

Both SENAI and SENAC are financed through compulsory contributions paid by the respective firms, calculated as 1% of their payrolls. In addition, some of the programs offered by SENAI are sponsored by the Ministry of Labor.

PIPMO programs are financed through Ministry of Education funds. Since PIPMO contracts courses with foundations and charity institutions at prices insufficient to cover the shadow-rents on buildings and equipment, it could be said that these institutions also finance the training programs, at least in part.

## 1.5 — The Relative Importance of Technical Education in Brazil

In our comparison of enrollment in technical and academic courses, we will restrict ourselves to the secondary level (that is, *ginásio* and vocational training), which is where the option between the two types of programs exists.

Table 1 shows the distribution of enrollment by type of course. At the *ginásio* level, only about 15% of the students have received any type of professional training, the remaining 85% being enrolled in the academic *ginásio*, which only prepares them for further education. Of the 15% that have received professional training, only 3.7% are enrolled in industrial programs. We can therefore see that within the *ginásio* system the effort to train industrial manpower is very modest.

At the *colégio* level, the degree of specialization is higher. Only 46% of the students are enrolled in science or humanities programs. Nevertheless, industrial courses absorb 5% of the enrollment. Accounting and teacher-training courses are the only numerically important alternatives.

Parallel to the academic cycle are the SENAI, SENAC and PIPMO programs; in 1970, 103 715, 146 052 and 88 290 were enrolled in these, respectively. Notwithstanding, the total number participating in such courses corresponds to only 10% of those studying in the conventional *ginásio*.

Such comparisons must take into account the duration of the courses. In SENAI, training lasts an average 300 hours. Conventional

Table 1

*Enrollment in Secondary Cycle and Vocational Programs, Brazil, 1970*

| Courses and Programs | Number of Students Enrolled | Distribution (%) |
|---|---|---|
| *Ginásio* Level (or 1st secondary cycle) | | |
| *Ginásio* (junior high school) | 2 590 889 | 84.1 |
| Commercial | 234 873 | 7.6 |
| Industrial | 113 207 | 3.7 |
| Agricultural | 11 730 | .4 |
| GOT (comprehensive) | 40 276 | 1.3 |
| *Normal* (teacher-training) | 85 183 | 2.8 |
| Other Courses | 4 043 | .1 |
| | 3 080 201 | 100.0 |
| *Colégio* Level (or 2nd secondary cycle) | | |
| *Clássico* and *Científico* (humanities and science) | 462 366 | 46.1 |
| Accounting | 219 101 | 21.9 |
| Industrial | 49 522 | 5.0 |
| Agricultural | 8 146 | .8 |
| *Normal* (teacher-training) | 262 690 | 26.2 |
| Other Courses | 488 | .3 |
| | | 100.0 |
| PIPMO (intensive vocational) | 88 290 | |
| SENAI[a] (industrial vocational) | 146 052 | |
| SENAC (commercial vocational) | 103 715 | |

Sources: Fundação Instituto Brasileiro de Geografia e Estatística — FIBGE, *Anuário Estatístico de 1971*, 1972; SENAI, *Relatório de 1970*, 1971; and SENAC, *Relatório Geral do SENAC: Balanço Consolidado do Exercício de 1970*, 1971.

[a] 45 775 692 student/hours. Due to training contracts between SENAI and PIPMO, the total enrollment figures count twice 25 607 trainees who took SENAI courses financed by PIPMO (Ministry of Education funds).

*ginásio* has a minimum legal duration of approximately 700 hours per year; in some industrial *ginásios*, this may reach 500 hours of work per year. Thus, a SENAI seat is used approximately twice, or by two students, per year, while a *ginásio* seat is occupied by the same student during four years.

From this different perspective, the weight of SENAI, SENAC and PIPMO is much greater. If, instead of comparing the enrollment as before, we compare the output of these programs

to that of the academic *ginásio,* we observe that the SENAI-SENAC-PIPMO system graduates a number of students equivalent to 40% of the total graduated by the *ginásios.* Nevertheless, such comparisons must be taken with due care since they may very easily be misinterpreted.

In summary, we could say that, at the school level, professional training is still very limited in comparison to traditional education.

## 2 — THE CLIENTELE FOR VOCATIONAL TRAINING: PROFILE AND SOCIAL FORCES

### 2.1 — Conditions for Access to Vocational Training: Selectivity, Educability and Social Level

Contrary to what may appear to be the case, vocational training courses of the SENAI type require an educational level far above the average reached by the Brazilian labor force. The minimum requirement is completion of elementary education, and it must be borne in mind that only about 14% of all Brazilians who start school complete the four basic years.

Examination of the personality traits which explain the learning ability or educability of persons in the conventional schools shows that most of these traits are related to the social level of the individual, i.e., his position in the hierarchy of society. The intelligence, attitudes and behavior patterns likely to lead to scholastic success are more often found among persons in the upper strata of society. There are not, however, any definite proofs that these differences are genetic. On the contrary, statistics suggest that the influence of variables associated with the family environment during childhood largely determine such characteristics. However, as these are assumed to be stable personality traits by adolescence, for the cases studied here the origin of the differences is of little consequence. Although the requirements for office jobs are even stricter, access to vocational and technical courses on all levels, and even access to manual jobs offering possibilities for promotion, is almost always determined by examinations and criteria which favor the more intelligent and the better educated. In this way, the higher one's position in society, the greater one's chance of being accepted for vocational courses or of obtaining access to the most desirable manual jobs in terms of income and promotion.

## 2.2 — The Lack of Interest in Vocational Training: The Sociology of Prejudice

On the other hand, a person's interest in vocational and technical courses will be lower if his social position is higher. This is partly because of the lower wages still paid by many such jobs. Traditionally, manual work was necessarily associated with low levels of power, prestige and income. Recently, however, many manual jobs have come to require specialized knowledge. The difficulty and cost of obtaining qualified personnel to fill such positions are reflected in the market today in the form of relatively high wages for these jobs. The congruence between wages and status has thus been broken.

Associated with and fostered by this occupation-status incongruence (between lower-level white-collar positions and specialized manual jobs which now pay better wages) is the barrier formed by the prejudice against manual work. The sons of white-collar workers are reluctant to accept skilled manual jobs. This group would have a built-in advantage over working-class boys, owing to the type of criteria governing entrance to courses and jobs. Moreover, by continuing to reject manual work, they are turning their backs on wages higher than those they could earn as office workers or salesmen.

There is evidence that in certain cases the influence of the school can overcome such prejudices. In some primary schools, where working-class boys predominate, sons of white-collar workers frequently show a preference for SENAI courses. In one industrial district surveyed, half of the sons of bureaucrats chose skilled manual occupations. Such a proportion is in sharp contrast to the preferences usually shown by this group. However, this influence is not permanent. As the critical moment for choosing a career and a job approaches, family and social pressure reasserts itself. The proportion of workers of white-collar origin did not reach 20% in our sample. Given the selectivity of the firms chosen, this share probably significantly overstates their participation in the manufacturing sector as a whole.

In fact, boys of white-collar background do not compete for the better manual jobs. Such jobs are thus "reserved" for sons of workers. It would nevertheless be misleading to view working-class boys as a homogeneous group. A clear-cut hierarchy is observed among blue-collar workers, depending on whether they are supervisors, skilled or unskilled. The same correlation between educability and social level observed for society as a whole extends to the manual job hierarchy. It can be seen that, with

regard to access to courses and good manual jobs, the higher the fathers' positions, the more heavily the group is represented, both in vocational courses and in the jobs which lead to the best positions in the blue-collar world.

We were able to gather evidence showing that SENAI courses and the higher-level manual jobs receive manpower which, from the standpoint of social origin, can be considered a blue-collar elite. The question then arises as to whether the evaluation of SENAI's results might be distorted by the positive self-selection of its clientele. Could the benefits measured for SENAI be merely quasi-profits or profits derived from a monopoly on intelligence or talent? It proved possible to demonstrate that this interpretation is not correct. Some fourth-year elementary students in working-class districts were put through the SENAI entrance examinations, and their performance showed that 62% of them would have satisfied the requirements. We concluded, therefore, that SENAI's selectivity is only moderate with regard to the group that has completed the four-year elementary school. At present, SENAI enrolls only a small proportion of the persons having the necessary aptitudes and qualifications.

## 3 — THE LABOR FORCE AND ITS MOBILITY

### 3.1 — Class and School Barriers: The Paradoxes of Intergenerational Mobility

When we look at the educational background of the Rio de Janeiro manpower sample, we find a surprisingly high level of formal education. There are practically no illiterates (3%) and only a small percentage of workers (13%) who have failed to complete elementary school. The modal class has completed elementary school (26%) and the remainder have had at least some secondary education (*ginásio* or *colégio*) . These figures contrast sharply with educational statistics for Brazil as a whole, which show that almost 80% of the population have not completed elementary school. Even a comparison between our sample and the data for Rio de Janeiro as a whole reveals substantial differences.

Looking at the sample in terms of technical or vocational training, we also find an enviable situation. Almost half of the sample have taken at least one vocational or technical course. It should be emphasized that, except for the lowest level skills (janitorial, etc.) , the sample covers practically the manual

work force of the firms in question. Moreover, the courses taken are practically always extended ones. One-fifth of the workers have attended courses lasting more than 1 000 hours, while only 18% have taken courses lasting less than 50 hours. These figures do, of course, differ greatly from the averages for Brazil as whole, reflecting the presence of small and medium-sized firms.

When we compare the distribution of fathers and sons by educational level, we find a notable rise in the educational level of the younger generation. However, this merely reflects the expansion of education in Brazilian society. It would be unwarranted to interpret this as intergenerational mobility (as some authors have done), since statistics on occupational status clearly show that confirmation of the father's status is the norm in our sample. Only 17% of the workers have fathers in nonmanual occupations. In other words, there is a tremendous reluctance on the part of the middle class to accept manual jobs, even highly skilled ones. This confirms the conclusions we drew on the basis of the students' aspirations.

## 3.2 — Upward Movement and Stagnation: What Are the Rules of the Game and the Advantages to Be Gained from Vertical Mobility?

Consistent with what has been found in other societies, there is a close correlation between the nature of the first job that a worker accepts and his career path. Those who begin their careers in jobs holding little prospect of promotion will probably make little progress during their working life. The facts show that, of the work force in the large firms offering the best positions within the hierarchy of manual occupations, less than one-fifth had started in occupations in which learning and promotion were not already inherent to the nature of the job. Relatively few, therefore, had entered the "wrong" jobs when they started in industry. We do not know for certain whether there is a marked process of natural selection at the time of the first job, or whether the chance step represented by this first job seals a destiny not actually determined by previous qualifications.

Comparison between the workers' training profile at the time of the survey (industrial technicians being excluded) and their profile at the time they joined the firm suggests that a large proportion of the men hired by the enterprises had not taken vocational courses or were still in training. Thus, a large part of a worker's skill is acquired after he enters the firm. In

addition, those who have taken vocational courses are more rapidly promoted from apprentice to skilled worker and, later, to supervisor or foreman.

## 3.3 — Job Changes and Specialized Training: The Fallacies of Horizontal Mobility

Considering the range of courses taken by workers, together with the applicability of these courses, we find that certain expectations for perfect congruence between course and occupation (which might imply excess rigidity) are not met. But the analysis also refutes the pessimistic criticism of those who place sole faith in "general" education, alleging that the market does not offer any compatibility between occupation and vocational training, thereby rendering the latter redundant.

Whatever a person's previous occupation may have been, the courses he has attended most always have a bearing on his present occupation. As shown in Table 2, only 9% of those who have taken courses are working in areas where those courses do not make some obvious contribution. In those cases where there is no relation between course and occupation, the job is usually a simple and repetitive one for which any type of course would have been redundant. Therefore, the question is not one of discrepancy between course and occupation. Although more than half the workers changed occupation after they entered the firm, we should re-emphasize that only a small fraction had taken courses unsuited to their present occupations.

It is important to note that the firms sampled generally look not for formally trained manpower, but for trainable manpower. They seem to take the view that it is worth paying more to hire a worker who already has some experience. And it is also worth putting a candidate on the shop floor for a while to observe how he gets on before sending him to a technical course. Nevertheless, the firms do not feel that the previous experience must necessarily have been in the same field.

Our analysis suggests that, among the industrial occupations, the more specialized training programs are in fact the least "specializing" (Table 3). Workers who receive specialized training, based on in-depth learning of just one skill, ultimately receive an education which gives them greater flexibility when they change occupation than those who have had formal education plus on-the-job training. The combination of supposedly general education — first secondary cycle (*ginásio*), for example — and working experience produces workers who change occupation

## Table 2

*Applicability of Courses Taken by Workers in Five Rio de Janeiro Firms Distribution of Workers (%), 1972-1973*

| Firm | No Course | All Courses Corresponding to Occupation | All Courses Related to Occupation | At Least Half Corresponding | At Least Half Related | At Least Half Corresponding, Some Related | At Least Half Related, Some Corresponding | At Least One Corresponding | At Least One Related | No Relation | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cruzeiro do Sul | 28.3 | 15.1 | 33.0 | 1.2 | | 6.4 | 5.0 | 1.2 | 3.0 | 2.4 | 10.6 |
| | (142)* | (76) | (166) | (6) | (22) | (32) | (25) | (6) | (15) | (12) | (502) |
| Rede Ferroviária Federal | 75.4 | 8.1 | 5.1 | .6 | .6 | 1.1 | .9 | 1.5 | .8 | 5.6 | 27.0 |
| | (963) | (107) | (65) | (8) | (8) | (14) | (11) | (19) | (10) | (72) | (1 277) |
| Ishikawajima | 28.0 | 28.8 | 16.1 | .2 | 2.6 | 5.5 | 1.9 | 7.3 | 3.0 | 6.6 | 23.0 |
| | (306) | (314) | (176) | (2) | (28) | (60) | (21) | (80) | (33) | (72) | (1 092) |
| General Electric | 71.0 | 6.5 | 6.1 | .1 | 1.0 | 3.0 | 1.5 | 1.2 | .7 | 8.9 | 20.7 |
| | (697) | (64) | (60) | (1) | (10) | (29) | (15) | (12) | (7) | (87) | (982) |
| Standard Eléctrica | 48.7 | 11.3 | 6.3 | 1.8 | .6 | 3.5 | .8 | 4.2 | 1.5 | 21.3 | 18.7 |
| | (431) | (100) | (56) | (16) | (5) | (31) | (7) | (37) | (13) | (190) | (886) |
| Total | 53.6 | 14.0 | 11.0 | .7 | 1.5 | 3.5 | 1.7 | 3.3 | 1.6 | 9.1 | 100.0 |
| | (2 539) | (661) | (523) | (33) | (73) | (166) | (79) | (154) | (78) | (433) | (4 739) |

*Figures between parentheses indicate the number of observations in each cell.

less often. Contrary to the criticism leveled at frequent changes of occupation as one of the failures of vocational education, we feel that these changes may result from the greater flexibility acquired by workers who have received specialized training. In all the cases we examined, these changes represent not failure or escape from poor jobs, but rather career progress, since the wages received by the workers in their new occupations are at least equal to those earned by their fellows who remained in their original occupations.

Table 3

*Percentage Distribution by Type of Education. Respondents Working in Occupations Related to Vocational Courses, and Mean Differences in Wages Received by Workers in Related and Nonrelated Occupations, São Paulo, 1970*

| Type of Schooling | t Value of the Difference | Degrees of Freedom | % in Related Occupation |
|---|---|---|---|
| 01 Short Courses | 1.48 | 281 | 89.8 |
| 02 SENAI | 2.30[a] | 1 091 | 77.7 |
| 03 Courses of Unknown Duration | 7.99[b] | 1 698 | 81.8 |
| 05 Industrial Technical School | 6.04[b] | 1 567 | 70.6 |
| 06 Courses Taken Abroad | 1.76 | 184 | 78.5 |
| Elementary | .65 | 372 | 91.1 |
| Junior High School | ..54 | 461 | 89.8 |
| High School | 2.24[a] | 301 | 89.1 |

Source: Instituto de Pesquisas Econômicas — USP/SENAI.

[a] Significant at 5%.

[b] Significant at 1%.

Note: In the case of respondents with only academic education (elementary, junior high school, high school), the comparison was between the first and the present occupation.

Technical education, like academic education, may contain an element of "learning how to learn". The characteristic feature of "learning how to learn" is the emphasis placed on general principles, on analytical reasoning. Ultimately, the purpose of vocational training is not only to teach the worker how to do something, but also to develop his ability to understand the logic behind the sequence of operations performed. Without this, his

work will be mere mimicry, and he will be unable to transfer what he has learnt to other occupations.

The traditional formula for "learning how to learn" consists in attempting to teach the general principles in such a way as to equip the student with a set of models for reasoning. However, here we are trying to educate people who are little predisposed to the operations and abstractions involved in logical reasoning. Brazilian workers usually come from families with extremely poor educational backgrounds, and, in most cases, from working-class families. Their linguistic codes are rather distant from the modes of expression employed in analytic thinking or scientific reasoning. The emphasis on language for transmission of knowledge makes formal schooling a painful and unproductive experience for them. The language they use is not that of the school, and their way of understanding the world is much closer to sensory perception than to scientific abstraction. Attempts to teach them general principles through language are not very effective. The way in which our elementary and secondary schools have always been organized makes them impervious to instruction in physics, for example.

SENAI, on the other hand, has succeeded in changing the entire approach to instruction. Major steps in this direction include restricting courses to a few areas of knowledge and drawing up science programs based on the discovery method. However, even more crucial than such classroom measures are changes in the nature of the course. Adopting a language which approximates that used among students with the social background in question, SENAI built its courses around its "methodical series", which are detailed sequences for masterng skills. What this involves is simply "learning how to do", leading in a detailed and exhaustive fashion to a high level of proficiency in the given area. Nevertheless, familiarity with basic processes, organized in a logical manner, gradually develops in the student a degree of intuitive understanding, albeit not always verbalized, of general principles. This method results in a feeling for, or understanding of, the logical way things function, bypassing the linguistic code generally used in science — a code to which the students do not possess the key.

For those who, as a result of their position in Brazilian society, do not have an opportunity to develop aptitudes for the special language of science and technology, the logical and exhaustive sequence of practical exercises provided by SENAI offers an acceptable substitute. By contrast, what has proved less acceptable have been superficial and poorly digested academic courses combined with work sequences, as found in the factory.

SENAI organizes work experience and training in accordance with a didactically progressive sequence. The factory is organized for production; from the point of view of instruction, the manufacturing processes are excessively complex and confusing.

Of course, not every vocational course will develop skills and allow vocational flexibility. Short-term courses, in particular, concentrate solely on "learning how to do", on the automatic reproduction of certain sequences of operations and movements.

## 4 — IS IT WORTH INVESTING IN MANPOWER? THE ECONOMIC RETURNS TO TRAINING IN INDUSTRY IN RIO DE JANEIRO AND SÃO PAULO

Economic evaluation of the results of investments in education is customarily performed with the aid of cost-benefit analysis. However, the number of simplifying hypotheses required and the multidimensional nature of education render such analyses only one of the items to be taken into account when making decisions in the educational field. Even so, rates of return offer a compact and convenient method for appraising the economic dimension of such investments, a dimension that is absolutely essential in any decision.

Nevertheless, it is important not to lose sight of the limitations inherent to cost-benefit analyses. A series of precautions were taken to this end, and it should be noted that it proved impossible to identify any factor that might produce gross distortions in the interpretation of our rates of return. In our sample, which is limited to skilled and a few unskilled manual occupations, social origin had a marginal effect on income levels.

In order to ascertain the degree of explanation provided by the variables in the Rio de Janeiro sample, a number of regression equations were computed, using wages as a dependent variable. We obtained coefficients of determination that in some cases were greater than 6, which is very high for analyses of this type. This means that these variables will enable us to determine at least 60% of the wage variations. The "number of vocational courses" variable produces expressive results in almost all cases, showing that the level of return is proportional to the number of vocational courses taken. In São Paulo, the rates of return for the various levels of education are markedly influenced by the size of the firms. In other words, significant wage differentials exist between firms of different sizes, with the large firms paying more.

However, the difference tends to lessen when we compare groups differing only in academic education.

Table 4 shows the rates of return for different types and levels of education in São Paulo. Several alternative hypotheses were estimated, but in the present paper only one is presented for each case. Table 5 shows the corresponding results for Rio de Janeiro.

When we further examine rates of return in São Paulo by occupational group, we find that the differences are not substantial, neither between different occupations nor between different levels of education within the same occupation. This suggests the existence of intraoccupational mobility, in addition to the interoccupational mobility already examined; together, these tend

Table 4

*Rates of Return by Type of Vocational Training and Academic Schooling, São Paulo, 1970*

| Vocational Training or Schooling | Rate of Return (%) | Vocational Training or Schooling | Rate of Return (%) |
|---|---|---|---|
| *SENAI* | | *Junior High School plus:* | |
| Drafting | 9 | Mechanics | 26 |
| Electricity | 37 | Group 91[a] | 8 |
| Electronics | 18 | Group 92[b] | 29 |
| Tool and Die Making | 46 | | |
| Mechanics | 33 | | |
| Metallurgy | 24 | | |
| *Group 91*[a] | 11 | | |
| *TECHNICAL SCHOOL* | | *High School plus:* | |
| Drafting | 12 | Mechanics | 39 |
| Electricity | 30 | Group 91[a] | 20 |
| Electronics | 0 | Group 92[b] | 43 |
| Mechanics | 31 | | |
| Metallurgy | 9 | *Aggregate Rates* | |
| Chemistry | 9 | | |
| Group 92[b] | 16 | SENAI | 24 |
| | | Technical School | 13 |
| | | Junior High School | 12 |
| | | High School | 23 |

[a] Includes production control, quality control, time and motion techniques, timing operations, time analysis and instrument reading.

[b] Includes product research and development, industrial planning and organization, production programming, computer and project design.

Table 5

*Rates of Return in Five Rio de Janeiro Firms, 1972-1973*

| Courses | Cost Estimate | Firms | | | | |
|---|---|---|---|---|---|---|
| | | Cruzeiro | Rede | Standard | Ishikawajima | General Electric |
| PC — PI | $C_1$ | 17 | < 0 | 5 | 9 | 5 |
| | $C_2$ | | | 6 | 10 | 5 |
| GI — PC | $C_1$ | | | 10 | 10 | 11 |
| | $C_2$ | | | 13 | 17 | 17 |
| GC — PC | $C_1$ | 12 | 10 | < 0 | 12 | 9 |
| | $C_2$ | 15 | 13 | 0 | 15 | 11 |
| | $C_3$ | 21 | 19 | 10 | [illegible] | 15 |
| GC — GI | $C_1$ | 21 | 13 | < 0 | 14 | 4 |
| | $C_2$ | 51 | 20 | 17 | 29 | 8 |
| GOT — and C — PC | $C_1$ | | | 13 | | 19 |
| | $C_2$ | | | 18 | | 29 |
| | $C_3$ | | | 15 | | 22 |
| | $C_4$ | | | 24 | | 43 |
| GOT — C — PC | $C_1$ | | 13 | | 18 | |
| | $C_2$ | | 21 | | 26 | |
| | $C_3$ | | 15 | | 21 | |
| | $C_4$ | | 33 | | 38 | |
| GOT I — PC | $C_1$ | | | | < 0 | |
| | $C_2$ | | | | < 0 | |
| GOT C — GOT I | $C_1$ | | | | 67 | |
| | $C_2$ | | | | 173 | |
| TI and C □ GC. | $C_1$ | | < 0 | | 113 | 18 |
| | $C_2$ | | < 0 | | 219 | 33 |
| | $C_3$ | | | | 199 | 30 |
| TC — GC | $C_1$ | 27 | | 37 | | |
| | $C_2$ | 53 | | 65 | | |
| | $C_3$ | 48 | | 60 | | |
| TC — TI | $C_1$ | 34 | | 30 | | |
| | $C_2$ | 57 | | 50 | | |
| SENAI — PC | $C_1$ | 16 | 8 | | 7 | 23 |
| | $C_2$ | 28 | 13 | | 19 | 43 |
| | $C_3$ | 34 | 14 | | 24 | 53 |
| | $C_4$ | 52 | 19 | | 39 | 81 |
| | $C_5$ | 64 | 29 | | 32 | 95 |
| | $C_6$ | 76 | 44 | | 11 | 106 |
| In-Plant Courses of less than 400 Hours' Duration | | | | | | |
| PC and GI | | 195 | | | | 337 |
| PC and PI | | | 300 | | | |
| PC | | | | 18 | 522 | |
| GI | | | | | 534 | |
| GI and GC | | | < 0 | 37 | | |

Codes: I — Incomplete, C — Complete; P — Elementary *(primário)*; G — Junior high *(ginásio)*; GOT — Comprehensive junior high, T — Technical high school; $C^1$ — Lower cost estimate; $C^2$ — Higher cost estimate, $C^5/C^6$ — Alternative cost estimates.

Note: For the TI and TC (Ishikawajima) and PI and GC (Standard) regressions the coefficients are significant only at 10%. For the remaining regressions the coefficients are significant at 5%.

to prevent the occurrence of pronounced imbalances between occupations and skills.

Examination of age-income profiles for Rio de Janeiro clearly proves that academic education has marked effects on income levels. However, as is also the case for the income profiles for

the economy as a whole, the differentials generally appear only after a few years of experience. Starting wages are little affected by the level of formal schooling. In other words, such schooling is reflected more in a person's higher potential to learn during his working life than in financial rewards at the beginning of his career.

On the other hand, vocational courses have not only a marked long-term impact on income profiles, but also a short-term effect even in the very first years of working life. In addition, the more vocational courses a group has taken, the higher its wage level.

Formal vocational courses of the SENAI type are often viewed as a mere alternative to on-the-job training. In other words, many argue that the profiles for workers who have and those who have not taken courses will eventually converge, once those who have not taken the vocational courses have had time to learn the subject matter through practice. Our figures convincingly refute this hypothesis. Not only do we not find convergence, but in some cases the profiles even grow apart with the passage of time.

One of the most consistent and most clearly demonstrated results is the superiority of SENAI as an investment for educating industrial manpower. In São Paulo, minors show rates of return of between 22% and 29%, while the rates for adult courses start at 59%.

One extreme case is provided by a comparison of those who have completed four years of elementary school and one year of SENAI, and those who have not only completed four years of elementary school, but also passed the secondary cycle entrance examination and finished the four-year *ginásio* course. It is interesting to note that, despite the great difference in educational level, the income profiles in Rio de Janeiro are very close, and in some firms are even higher for the SENAI category. In São Paulo, a similar comparison shows marked advantages for SENAI graduates. It should be noted that the São Paulo sample is representative of the manufacturing sector in the state as a whole.

For activities in which people "don't get their hands dirty", we may assume that the middle classes are better represented both in courses and in the competition for positions. The low rates of return observed in São Paulo for occupations such as drafting, quality control and chemistry can be clearly contrasted with the high rates found for machinists, tool and die makers, electricians and boiler-makers. This result suggests that the scarcity of trainable people in the lower classes and the aversion of the

middle class to manual occupations are responsible for the high levels of remuneration for certain manual occupations.

We also examined courses sponsored and conducted by the firms themselves (under agreements with SENAI). This study showed particularly high rates of return. Very high rates were observed for in-service training programs. Even if such estimates are biased upwards, due to positive self-selection, the return are so high (over 100%) that it is very unlikely that such courses do not have a substantial net effect.

Among the vocational-type academic courses, the GOTs (vocation-oriented junior high schools) showed surprisingly high rates of return. However, it should be noted that the number of observations is small and the results consequently not entirely reliable.

The industrial-technical schools in Rio de Janeiro show satisfactory economic results, despite the numerous difficulties reported elsewhere in this paper. Nevertheless, in São Paulo, where enrollments have expanded more rapidly, the rates of return are already low at between 11% and 17%. This clearly suggests that the market is already becoming saturated.

Looking at the situation of technicians in one of the firms employing large numbers in this category, we find that the income profile levels off and becomes horizontal after a certain number of years of experience. We suggested previously that dissatisfaction within a profession partly results from the fact that beyond a certain point there is no more progress, no more advancement. The technicians would thus be responding to stagnation and not to absolute income levels, which the profiles show to be high.

We also compared the position of technicians who are technical school graduates and the position of those who, though classified as "technicians" by the company, do not possess a diploma. The conclusions parallel those based on the earlier comparison between SENAI graduates and those who learnt only through practice. The advantage held by technicians with a diploma is clear: the "practical technicians", even if they have completed a SENAI course, cannot follow the same career patterns or reach the same income levels as the graduates. Once again, this suggests that in Brazilian society the position of the industrial technician lacks definition.

Conventional academic education gives slightly poorer results than technical courses. In particular, first-cycle secondary instruction gives rates of only 11% to 14%. In terms of the rates usually found in Brazil, these returns are very low.

This suggests that for the person who goes to work in industry, the investment in a *ginásio* education is not very satisfactory.

We feel that such poor results are due to the inadequacies of first-cycle secondary education as a preparation for children of working-class background. The curriculum is excessively ambitious in terms of the specific learning potential of working-class students, and the language employed is very remote from that of their home environment.

In contrast, workers who have completed the second cycle of secondary education (*colégio*) show much better results, with rates of return between 18% and 35%. This illustrates another theoretical point put forward in this paper: the fact that an individual has succeeded in advancing sufficiently far in the educational system shows that he has to a certain extent overcome the language barrier. *Colégio* graduates thus succeed, at least to some degree, in using their acquired analytical or conceptual skills to give meaning to work routines and to benefit from opportunities for on-the-job learning.

# 5 — THE ECONOMICS OF INDUSTRIAL TRAINING: SOME CONTROVERSIES

## 5.1 How Is Vocational Training Organized and Who Pays for It: The Anatomy of the Decision-Making Process

For Becker and Mincer, there is a close relationship between the training program a firm is willing to sponsor and the distribution of costs and benefits associated with each course: in their view, it is the possibility of reaping the benefits, or of passing on to the workers the cost of their training, that induces a firm to start its own training programs.[6] Examination of Brazilian firms shows a much more complex situation, in which the link between these two aspects is somewhat nebulous and is affected by institutional considerations.

From interviews with training personnel, we gather that, given the relatively modest level of qualification of the Brazilian work force, the chief issue in planning training programs is locating sectors where manpower bottlenecks are most seriously felt, i.e. fields in which the firm is less satisfied with the qualifications of the work force it has or can obtain on the

[6] See J. Mincer, "On the Job Training: Cost, Returns and Some Implications," *Journal of Political Economy* 70 (October 1962); and G. Becker, *Human Capital* (New York: National Bureau of Economic Research, 1964).

market. More urgent than the problem of later losing the trainee to a competitor, or of paying him less than his marginal productivity, the firm may be faced with the serious risk of not having manpower with a given skill. Theoretically, a firm ought to follow a rigid policy of offering only training of a type that can not be used by competitors on the labor market. (Casual observation of a few firms indicates that lavishness in this regard has given rise to some over-qualification problems, especially among the lower bureaucratic ranks.) Nevertheless, examination of the sample shows that firms do accord priority to training for skills not obtainable on the market, or not available in sufficient quantity, regardless of whether these skills may be widely utilized by competitors.

In theory, people can choose between occupations offering high starting pay and ones paying less in the beginning because of the investment in on-the-job training. After a certain point is reached, however, those who invest (and save) in the form of lower initial wages manage to increase their earnings well above those of the individuals who opt for higher starting wages. These assumptions appear to be fairly realistic in the case of the United States.

In Brazil, however, there is a uniformly narrowing educational pyramid (the higher the level of schooling, the fewer who reach it) coupled with a relatively high correlation between educational level and social position. This contrasts with the situation in the United States, where high school and college are the modal classes. As a result, there is much less rivalry within each educational group. The more the position offered depends on intelligence and related abilities, the higher up the educational pyramid an employer has to go to recruit staff.

Depending on the extent to which the employer wants workers who can be easily and quickly trained for an occupation, he will decide on a preliminary screening in terms of formal education. The higher the educational threshould stipulated, the greater the probability of finding people who meet the occupational requirements, and particularly people who can cope with the pace of the training program. As a consequence, there will be fewer candidates and they will therefore be more expensive.

As a result of this, income profiles do not intersect in the manner indicated by theory. In other words, certain jobs are better paid than others at any point in the career. There is a definite hierarchy for most occupations, implying that the worker does not choose between present and future. Instead, he

chooses the best job available to him in the light of his qualifications, and, in making his decision, does not need to consider his long-term preferences. Nor, as theory would suggest, do we find that the decision to enroll in a training program results in the worker's postponing his entrance to the labor market. Indeed, juveniles who take vocational courses may even start working at a younger age.

We were, of course, interested in the cost of each program offered by a firm. Formal training in classrooms or workshops, in-service or in schools, produces cost curves of a familiar U-shaped form. Owing to the high fixed costs of equipping the facilities, vocational training unit costs decline sharply with higher enrollment.

The cost of on-the-job training is more elusive, since it largely depends on the type of work done by the trainee in the factory. The training potential for a job will depend on the nature of the work. Certain repetitive and straight-forward jobs are dead ends in terms of mobility; these offer little potential for training (janitorial cleaning, handling materials, etc.). However, there are other occupations which, despite involving tasks of the simplest nature in the productive process, are naturally linked and in physical proximity to other, more complex tasks. Apprentices who have the opportunity to practice these tasks, with the informal assistance of experienced workmen, progressively develop skills of a higher order and in due time the firm finds that it has trained, at negligible cost, skilled workmen having an acceptable standard of proficiency. Nevertheless, to the extent that a firm needs to train a large number of apprentices at one time, it is inevitable that there should be a decline in their marginal productivity, and that each of them should make a smaller contribution to production. When the number of apprentices in the factory rises above a certain point, their marginal production can no longer be proportional to the payment received. Once a certain limit is reached, it becomes prohibitive for a firm to give its apprentices on-the-job training, since the ensuing crowding of the workshops may even jeopardize output.

We find, then, that as the number of trainees increases, the cost of on-the-job training rises, whereas the cost of school-type programs (in schools or in the factory) decreases. It seems reasonable to assume that, once the demand for labor of a certain type has reached a certain level, it becomes less advantageous to train workers on the job and cheaper to train them in organized programs. Geometrically speaking, there is a point at which the (increasing) curve of on-the-job training costs crosses the

(decreasing) curve of training at a school. From this point onwards, it will be more economical to offer formal programs.

The first important conclusion to be drawn from the foregoing is that the more rapidly a firm is enlarging its work force, the greater will be the number of courses or organized training programs, in contrast to supervised on-the-job apprenticeship. An expanding enterprise would find it very costly to give on-the-job training to all the new workers it needed.

One type of course that firms are able to operate to great advantage is that for training semiskilled labor for production lines and semiautomatic machines. These are inexpensive courses that develop a "specific" skill, in the sense that they quality the worker to carry out only certain highly specialized operations not often duplicated in other firms in the neighborhood. Firms are thus able, without difficulty, to recover the cost of training. This is the only case for which our evidence fits conventional theory.

This, indeed, seems to be a top-priority area for training programs, i. e., for developing skills which are unavailable or in short supply on the labor market. In examining the firms in our sample, we found that many of the training programs run by them came into this category.

The training of apprentices might have been expected to call for smaller investments than we found to be the case, since firms could have availed themselves of SENAI facilities. We have justified the offering of training programs mainly in terms of the economies of scale that are possible when there is a large flow of apprentices. Even though apprenticeship training programs such as those offered by SENAI produce workers capable of being employed in various trades, there are two additional factors that induce firms to opt for the vocational training of juveniles. Firstly, the overall length of the programs is shortened, since the periods of apprenticeship required for adaptation to and specialization in the requirements of the firm are incorporated in the training itself. Secondly, the course will have an effect on the attitudes, values and opinions of the apprentices. A course such as this not only constitutes an adequate means of imparting general information regarding the firm, but also serves to inspire attitudes that are favorable to and in harmony with the firm's own principles and objectives. It must be kept in mind that, by operating such courses, firms spend more on training than they would spend were they to hire SENAI graduates. And, since they train a type of labor that is of a "general" character in Beckers's sense of the word, it is impossible to explain the lavish provision of this type of training in terms of having the worker

pay for his own training (the apprentices earn the minimum wage, which is the wage paid to practically all minors). Likewise, it is impossible to justify it in terms of the supposedly "specific" nature of the training provided, for there is usually a large market for the skills taught.

One final consideration is that the training programs provided by a firm at a given point in time reflect its past history, that is, the composition of its personnel in terms of age and experience. There is no single set of formulas or schedules for organizing training programs applicable to each and every firm. A firm's history and its past training policy, rather than any set of textbook principles, will dictate the most suitable policy to be followed at any particular stage. For instance, firms with an older labor force will offer courses on new processes and equipment. Firms with very young workers will offer apprenticeship programs. Firms interrupt courses when an over-supply of labor has been generated, and replace them with others in areas of greater scarcity at that moment.

In observing the organization of the training that firms provide, we have found that, though this frequently diverges from theory, it follows a consistent pattern as the result of relatively simple decision-making schemes. It is important to note that there is a rational and harmonious distribution of training responsibilities between enterprises and SENAI. They do not compete with, but complement one another.

## 6 — MANPOWER QUALIFICATIONS: CAUSE OR CONSEQUENCE OF PRODUCTIVITY?

We found the levels of training and formal education of the sample of workmen in five large industrial firms in Rio de Janeiro to be remarkably high compared to the average Brazilian firm, or even to smaller concerns of a lower technological level. This led us to wonder about the relationship between this exceptional qualification and the high productivity of the enterprises in question. If these are the most productive enterprises, and if they have been induced to hire atypical manual labor, why did they do so, and what are the implications of that decision?

We might take the conventional view of the human capital theory, which links high labor productivity and high formal qualification of work force in a cause-and-effect relationship. We might equally well consider an explanation along opposite lines, taking education to be a by-product of the wage and

productivity differentials inherent in the capital and technology of the firm. The more profitable firms would be prepared to distribute part of their surpluses among the employees, thus making their jobs more attractive. This would naturally result in an excessive number of people looking for jobs with such firms. While nepotism and favoritism were common when hiring labor in the past, they are now being rapidly abandoned. Today firms seek to apply objective criteria, such as formal education and tests. The selection departments themselves do not really know whether they are setting excessive educational requirements for each post. Their purpose is merely to choose between candidates. In line with this explanation, education could be considered an item of "conspicuous consumption".

We cannot judge whether the first or the second of these two alternatives better represents what in fact happens. Notwithstanding, a more convincing line of argument would appear to be circular in nature:

(i) The financial surplus earned by these firms enables them to hire labor that is more capable, hardworking and inclined to accept management's authority. The criterion of formal education is, more than anything else, a basis on which to select those qualities which serve to differentiate the candidates chosen from those who gave up their studies before reaching the level required by the enterprise. Quite apart from the effects of education, these candidates display the qualities of intelligence and behavior that are most desirable in industrial manpower. In addition, the school is typically a medium through which the individual is adjusted to be incorporated into the industrial social system, so clearly identified with the large corporation.

(ii) The threshold of ability to carry on an occupation is much lower than the minimum qualifications required to complete training for that occupation within a relatively short time. A firm is not interested in people who are trainable for a particular job, but in those who can be trained within a given period. This gives rise to higher requirements in terms of intelligence and formal education than those needed for eventually performing the job well (or better).

(iii) Higher wages place a company in a buyers' market for labor, reducing dissatisfaction and union problems.

(iv) One of the most important consequences would be the lowering of the managerial level at which decisions

are taken. A less qualified work force, by requiring more supervision, overloads each managerial level with concerns that compete with the time needed for decisions having a major impact on efficiency and growth. A more qualified work force enables management to devote more time to nonroutine activities and planning.

(v) In turn, these effects would exert a favorable influence on productivity, especially medium and long-term productivity.

## 7 — EDUCATIONAL REFORM IN BRAZIL: "BRITISH" MODEL OR "AMERICAN" MODEL?

In 1971 the Brazilian government established new educational legislation. At the core of this reform lies a rather delicate ideological question. Essentially, it relates to the method of organizing the educational system. In order to simplify discussion, let us consider two alternative educational systems. One of them is a linear, one-track system, through which everyone passes and in which everyone is given the opportunity to reach the highest level of achievement. If any vocational education is offered, it is linked to the same set of course offerings or syllabuses. In broad outline, this type of organization is well illustrated by the American system. In the other system, there are various branch-off points, and at the forks are chosen those students who will enter the terminal branches (vocational programs) and those who will continue to the next fork. A good illustration of this type of structure is the traditional British system.

The latter has been considered more "elitist", making education a means of confirming "status". One may indeed find that the correlation between the distribution of pupils within each branch and the distribution of socio-economic status in the community is higher for this system. Furthermore, it should be pointed out that the introduction of free tuition and fellowships has helped to make British schools only slightly less socially selective. This suggests that among the factors that determine schooling, there are some more powerful and perhaps more resistant to change than the economic ones.

The single system (polytechnic or comprehensive schools) may seem more attractive. Theoretically it offers greater equality of opportunity: there is no segregation in the schools, all students

of all origins attending the same schools and essentially the same classes. Not everyone goes as far in school, but as long as one continues to study, the school is the same. However, the implementation of this system is fraught with difficulties.

The Brazilian educational structure had been slowly moving from the "British" to the "American" system, and the recent educational reform gave it a vigorous push in that direction. An overall evaluation of the change would be premature, and, from the point of view of the present essay, inappropriate.

It is, however, possible to consider certain negative consequences of the new system. The most relevant question here is whether it is possible to operate, in one and the same school, both a vocational training course and an academic program. This is a legitimate question, for a school is a social institution, an organization with its own "social conscience", its own "ethos". Like any other group, it develops its own rules, its own values. This occurs at both pupil and teacher levels. Nevertheless, its operating rules are neither fortuitous nor entirely idiosyncratic. On the contrary, with due adaptations, they reflect the standards of the participants, and, furthermore, the class values of the majority groups involved. Insofar as the Brazilian secondary school is — and will be for many years to come — largely dominated by groups drawn from the country's middle and upper classes, it is the values and standards of the middle and upper classes that will predominate. In practice, this means that both teachers and pupils are obliged to adapt to the values of the dominant group.

How, then, will it be possible to run vocational courses in an efficient manner when the social group that sets the tone is contemptuous or condescending regarding the intrinsic values of many of the trades that will have to be taught? How will it be possible to offer, in schools in which the standards and values of the group are exclusively dominated by middle-class social values, programs designed to prepare pupils for manual work? The Brazilian experience gives little reason for encouragement, unmistakable failure having been observed in several of the cases examined.

Given the predominance of the middle class in Brazilian secondary schools (i.e., *ginásios* and *colégios*), we feel that efforts to provide, as part of a standardized program, courses designed to prepare pupils for manual occupations are most unlikely to succeed. What we have observed is that the sons of workmen themselves tend to acquire middle-class values when they

attend a secondary school, losing interest in and even refusing to accept manual occupations. Bearing in mind the steady rise in wages for highly qualified manual workers, transforming the sons of the most able workmen into mediocre bureaucrats who will simply swell the supply of white-collar proletarians amounts to giving way to misguided popular pressure.

This unifying doctrine may also have the consequence of reinforcing the tendency to postpone choosing a career. The very idea that the comprehensive junior high school (GOT) should not offer a terminal vocational program well illustrates this point. To put pupils through nine years of education without giving them a trade or profession is to opt for an elitist arrangement, considering the tiny fraction of Brazilians who reach this level.

The argument that the adolescent is not capable of choosing his career lacks foundation. SENAI experience shows that workers who take SENAI apprenticeship courses do not encounter adjustment problems, in spite of the fact that when they choose their trades they have had no more than four years of schooling. Furthermore, job changes have no negative effect on their careers.

Our research leads us to ask whether, since it enables better use to be made of the secondary school intake, the "British" model, with its various bifurcations, would not be more suitable, at this moment in Brazil's history, than the "American" model. The situation may be different 10 or 20 years hence. However, at present, it appears to us more sensible to accept the need for a system having successive "forks", than to choose a formula which, though theoretically more equitable, would in practice aggravate the conflict between the "ethos" of the school and the nature of the vocational courses, thus giving pupils of humbler origin still fewer real opportunities.

It is symptomatic that the best technical training can be obtained through the courses run by SENAI or under agreements with SENAI, which are the main exceptions to the new Brazilian system of education. It is therefore of some relevance to discover that this parallel training gives better results than does the academic system. The alternative of technical training incorporated in the academic educational system is, on the other hand, in a state of crisis. Our research indicates that the industrial-technical schools are in a rather delicate situation, and that in the comprehensive schools (junior and high) the students do not take vocational courses seriously.

## 8 — CONCLUSIONS

In the study summarized in this paper, we examined the issue of training manpower for Brazilian industry. This field has received little systematic treatment in the literature. Part of our purpose was to describe how training operates and to identify the major problems and questions. In identifying the salient questions, our starting point was the literature based on the human capital theory. One of our basic concerns was to determine to what extent it offers models that adequately describe the concrete situation in Brazilian industry. We were able to anticipate that although the basic concepts and approach of the human capital theory lead to a better understanding of the problems studied, institutional differences greatly restrict the applicability of the models in the more explicit forms proposed in the literature. In many cases, these models even point to erroneus solutions. We did not confine ourselves to the purely economic aspects of manpower and its training. On the contrary, this study is an interdisciplinary work, extending to discussion of strategies for the teaching and training of industrial manpower, questions of intergenerational mobility and mobility within the labor market, the educability of candidates for vocational education and training, and the attitudes and values related to career choices.

Special mention must be made of the time spent on gathering and processing the data. We are naturally skeptical about the conclusions that can be drawn from information of unknown reliability. The firms studied allowed our field investigators great freedom of action and collaborated in the checking and critical evaluation of the results. In many cases, we personally interviewed staff members and engineers at the administrative and production levels. Thus, with few exceptions, we have great confidence in the data presented. The data on wages, usually of doubtful reliability, are absolutely correct, having been checked by supervisors or personnel officers.

However, it should be remembered that our conclusions are based on two samples with rather special characteristics. As we were dealing exclusively with production personnel, the administrative staff were not included in the analysis. Nor did our examination extend to the managerial staff. For Rio de Janeiro, our sample comprises firms which, though operating in different sectors, are all large. This characteristic greatly limits the scope of the potential conclusions. In Rio, all the manual workers of the firms were interviewed; but in São Paulo, though the sample is representative of the manufacturing

industry in that state, only middle-level technicians and skilled workers with some supervisory capacity were interviewed, thus excluding a large segment of the skilled labor. Both samples consist largely of "upper echelon" manual occupations, i.e., mechanics, electricians, electronics workers, etc. By the nature of the industries included, some skills, those in the construction industry for example, are omitted or underrepresented.

It must be stressed that we are at all times discussing alternative ways of training manpower for industry, and not the career alternatives facing a student from this or that social group. To have dealt with the latter, it would have been necessary to have considered the options available outside the manufacturing sector.

We present below some of the main conclusions of this study.

## 8.1 — Economic Findings

Investments in training industrial labor almost always showed excellent economic returns. In spite of all the methodological and statistical restrictions of cost-benefit analyses, the high rates of return suggest that investment in this area yields significant results.

Training and apprenticeship courses have a clear advantage over academic education and on-the-job training. This finding is contrary to the convictions of those who believe that "general" education provides a better preparation for the market, and that specialized training is best acquired on the job. Insofar as Brazilian industrial manpower is concerned, structured and formalized vocational training has proved to be a much more profitable investment than the combination "academic education plus on-the-job training", advocated particularly in American literature.

We have also shown that academic and vocational courses are complementary in the sense that both, separately or in combination, raise the level of individual output. Nevertheless, a person who has completed primary school and SENAI (industrial-vocational) training usually reaches higher output levels than a person who has completed the lower secondary cycle but has not taken any vocational course, despite the fact that the latter has had at least four additional years of schooling.

An important question that could not be adequately dealt with is that of choosing between courses for minor apprentices and courses for workers already employed who are looking for more

methodical and thorough training. The psychology of learning would suggest that adults are less trainable than minors, quite apart from the experience they have gained during the years preceding the course. On the other hand, we know from SENAI itself that, for various reasons, 23% of the minor apprentices end up in occupations not even remotely connected to the subject matter of the courses.

Because our sample is composed of industrial firms, it naturally does not provide an insight into the occupational distribution of all graduates. Nevertheless, we were able to determine that, within the industrial sector, there is fairly high consistency between training and occupation. The more training the worker has, the more likely it is that when he changes occupations he will transfer to a related field, in which the knowledge he has previously gained can be turned to best advantage.

The industrial-technical courses (high school level), though showing good rates of return in Rio de Janeiro, are yielding disappointing results in São Paulo.

The theory of human capital leads us to consider the productivity levels achieved by an enterprise partly imputable to the education of the labor force. We do not believe that this rigid cause-and-effect relationship has been sufficiently demonstrated. In large enterprises in Rio de Janeiro, educational requirements may in some cases be simply a mechanism for screening candidates for top-paying jobs. As these are firms that operate at a considerable profit, they can afford to pay better. For many of the occupations examined, the requirements in terms of academic education were clearly excessive. On the other hand, it must be borne in mind that the Brazilian legislation itself, by requiring firms to finance the complete elementary schooling of their workers, leads them to hire staff who have already completed that course.

We believe, in fact, that there is a circular relationship between the productivity of an enterprise and the educational level of its labor force. The high efficiency of the enterprise allows it to invest in a better educated labor force, and this in turn effects productivity. In particular, we believe that the most important effects are indirect. A more educated person is easier to administer within a large organization, he has a higher degree of motivation, and his values are more in line with those of the social group. Moreover, he is better able to carry responsibility and make decisions, thereby lightening the load of his superiors and enabling them to devote themselves to tasks more directly related to increasing productivity.

Another dangerous interpretation is that a skilled labor supply creates its own demand, an assumption upon which SENAI seems to have acted in less industrialized states. There is no evidence that the opening of technical or vocational schools attracts industry to a region or affects the rate of industrial growth. It is possible that a dramatic shortage of skilled labor somewhat reduces the rate of growth, but it is not the supply of skilled labor that is going to determine industrial growth. The significant favorable results of technical training in Rio and São Paulo cannot be explained without taking the thrust of the industrial growth of those states into account. And to explain this growth is a complex task which cannot focus on a single factor such as human capital.

## 8.2 — What the Students Want, and What the Schools Offer

A course or training program is conceived and conducted with certain specific notions about the functions it is expected to perform. On the other hand, the students or enrollment candidates have their own ideas about what the course can offer them, and these do not necessarily coincide with the objectives envisaged by the school. The goals of a course can be frustrated by structural rigidities of the labor market and by prejudice.

Our investigation turned up many problems of this nature. The technical schools offer a self-contained course, of good quality, with a guaranteed market (at least in Rio de Janeiro) and with fairly high initial earnings. However, the students regard this course as preparatory training for the university. As a bonus, it offers an easy-to-get job, so that university studies can be financed later, or even simultaneously. In addition, the high initial earnings lead to stagnation later, as a result of which the "technicians" become restive and dissatisfield in their jobs. The firms, in acknowledging the job instability of these individuals, aggravate the problem by denying them positions of responsibility and promotion prospects within their hierarchical lines.

A school does not only impart information; it also socializes the students within a system of values and attitudes which reflect the behavior and ways of thinking and the social position of the majority of the students and teachers. In a fairly uncommon situation, we were able to observe lower-middle-class minorities aspiring, once they had completed their elementary education, to skilled manual occupations and vocational training courses. This was only because they had attended schools in working-class

districts, where the dominant values were those of the working class. But the more usual case is that of the secondary schools having a predominantly middle-class enrollment (at least 80% of the students). These schools develop prejudiced group values in relation to the technical and manual (even though highly skilled) occupations. Both middle-class and working-class children come to develop the same disdain for these occupations, thereby completely thwarting all efforts to "vocationalize" middle-level education. The few children of workers who complete the secondary cycle join their middle-class peers in rejecting the occupations of their fathers.

The graduates of the *ginásios orientados para o trabalho* (vocation-oriented, lower-level secondary schools) show satisfactory performance. In fact, however, this course leads few of its graduates (1.5%) to take up manual occupations.

Although it must be admitted that forcing an occupational choice on an adolescent is a difficult matter, the Brazilian educational system postpones vocational training to the point that it is reached by only about 10% of Brazilians who entered school. It appears to us that the absence of choice is more serious than an immature choice.

There is thus a sharp discrepancy not only between what the schools offer and what the students expect of them, but also between both of these and the harsh realities of the situation.

## 8.3 — The Alternatives Open to the Manual Worker

When the research project that materialized in the present report was initially proposed, the terms of reference contained comments that could hardly be called favorable to SENAI. At that time, we expected to find that the cost of SENAI programs was excessively high and the training insignificantly better than that obtained on the job. The results of the research completely shattered our initial hypotheses. The SENAI schools are not necessarily more expensive than in-service programs. Moreover, the results of SENAI training, or of training given under agreements with SENAI, have been exceptionally satisfactory.

SENAI is seen a posteriori to be one of the most successful experiments in the history of Brazilian education, and it is noteworthy that several countries in Latin America have used SENAI as the model in organizing their training programs.

We believe that because of the techniques of programmed instruction and individualized teaching that it uses, SENAI has great potential for expansion. It minimizes dependence on the

human factor, which is particularly erratic and difficult to coordinate in very large organizations. Moreover, our investigation indicates that a human resource potential exists that would guarantee the sustained quality of SENAI candidates even if enrollment were many times the present figure. The high rates of return do not, of course, tell us anything about what would happen if such expansion were to take place. There would inevitably be a reduction, though it is difficult to assume that the market would be saturated in a short time.

Nevertheless, quite apart from prescribing some optimum rate of expansion for SENAI, there is a farther-reaching lesson to be learned:

(i) — SENAI offers the best example of the possibilities for intelligent adaptation of education to the true potential of the children of the lower classes. In the field of academic education in Brazil, the examples of innovative and modern education are limited to some private schools which apply the methods inspired by Montessori and Piaget. These schools cater precisely to the upper strata of society, which least need such methods of education.

(ii) — The SENAI experience demonstrates the appropriateness of teaching a few concepts instead of "running rapidly and superficially through broad areas of knowledge". We suspect that this method has thus avoided one of the chronic evils of Brazilian education. The SENAI programs, whether in the classroom or the shop, drastically restrict the material to be presented to the students. As a result, the students are able to throughly absorb what is taught and to add it to their intellectual repertoire.

It is significant that SENAI has been able to maintain its standards over the years. The system has expanded without its quality suffering. This is more than can be said of the majority of Brazilian educational institutions. Perhaps this is attributable to the difference in its decision–making mechanisms. Generally speaking, the supply of education responds to the pressures exerted by candidates wishing to enroll. Since these demands for places are rarely accompanied by demands for quality, standards are sacrificed. This does not happen in the case of SENAI. The working class is traditionally incapable of organizing itself around educational demands, not only in Brazil but practically everywhere in the world. Any pressure for increased enrollment in SENAI

would come directly from the enterprises that use SENAI-trained manpower. However, because business naturally insists on quality as well as quantity, it is business itself that would have to cope with the consequences of any lowering of standards. The explanation for the maintenance of SENAI's quality may lie in this direction. The reader should beware reading into this paragraph a value judgment or a policy implication. What is intended is no more than an attempt to understand a historical process.

The good results obtained through SENAI have been attributed, a priori, to cognitive abilities and manipulative skills acquired during the course. The content of the course, and the way in which it is usually conducted, do in fact give plausibility to this hypothesis. Nevertheless, we cannot rule out the possibility that the results achieved are due, at least in part, to noncognitive factors.

The mere discipline, organization and willpower required to complete a course successfully have a great deal to do with subsequent on-the-job success. However, what we are concerned with here is not the significance of successful course completion, but rather the possible differences between SENAI and the academic courses in these noncognitive aspects.

SENAI is a self-contained course, conducted by a business-sponsored institution operating with a built-in feedback mechanism to the manufacturing sector. This means that the course focuses on the real training needs of firms. And no doubt this higher degree of coherence is also true for noncognitive areas.

We have accordingly observed that, compared to the academic system, SENAI emphasizes values, attitudes and aspirations more consistent with the jobs the trainees are likely to fill. Thus, greater emphasis is placed on discipline, punctuality and organization. For those from the lower levels of Brazilian society, dealings with persons invested with authority are tense and difficult. In comparison to the academic schools, SENAI may possibly prepare the trainee better through objective contacts with authority, Similarly, the trainee's methodical and thorough execution of the tasks in the SENAI "methodical series" leads to his developing a taste for the occupation being learned, as well as a sense of dignity and professional pride. The group dynamics necessary for the development of these values and convictions would be difficult to reproduce in the academic courses. Nor is work in the factory an entirely adequate substitute for this initiation.

The trainees are taught to accept and to adjust to the social and hierarchic system of the factory. On the other hand, they reach levels of financial and vocational satisfaction that, in the Brazilian context, are quite reasonable. From another point of view,

however, they are indirectly led into a certain political and ideological conformism. It is not for the author of this study, who is neither a worker nor a representative of the class, to express value judgments on conformism and social justice.

Classification of the sample according to the occupational status of the respondents' fathers reveals that only 17% are in nonmanual occupations. In other words, manual workers are also the sons of manual workers. Althought class barriers are usually believed to restrict upward mobility, in this case exactly the opposite happens. The prejudice against manual occupations deprives the lower middle class access to a large number of jobs that nowadays offer better pay and greater stability, but which traditionally belong to a lower class. Because of the selection mechanism used by the technical and vocational courses, and no doubt also by business itself (length of schooling and testing), the higher the social class of the individual, the greater his ability to compete in these examinations. As a consequence, class barriers are creating a protected market for the manual worker class. But, since relatively few working class children have the cognitive development and formal education necessary to rapid qualification, a scarcity of certain types of highly skilled workers seems to have arisen. It is reasonable to assume that some of the extremely high wage levels observed are due to quasi-profits from this origin. In fact, in São Paulo the rates of return are higher in the characteristically blue-collar positions. These are the machinists, toolmakers, electricians and boiler-makers that dirty their hands and work in shops. In occupations such as drafting, chemistry and quality control, where we might well expect lower levels of prejudice on the part of the middle class, we observe much lower rates of return. These results suggest that it may in fact be the prejudice against manual occupations that sustains the acute scarcity of skilled manpower.

The typical SENAI graduate usually goes to work in a large, modern concern. This is mainly because wages and salaries are higher in large enterprises. But there also appear to be other, subjective reasons. Our personal observations suggest that the SENAI student develops a taste more for technical perfection than for improvisation. His training leads him to expect total logistical support, with the aid of which he will devote himself to producing at the highest degree of perfection possible. The school inculcates in him a concept of order and fastidiousness, of methodical, step-by-step working in logical sequences. It seems to us that, from this point of view, it creates an employee dependent on the organization or the enterprise. In this sense the SENAI

graduate is trained to work in large enterprises, in which these conditions are more likely to be present. Moreover, his first job is almost always set up by SENAI itself, which for obvious reasons has better contacts with enterprises that can absorb large numbers of its graduates.

In spite of these observations, we do not believe there is evidence to confirm that training which emphasizes values contrary to improvisation and diversification necessarily makes the trainess less capable or less efficient in jobs in which these latter qualities are of vital importance. In fact, it must be borne in mind that the thorough training received at SENAI is adapted to the diversity of situations and the relatively low degree of standardization which characterize the tasks in small and medium-sized concerns. In this sense, the first jobs in large concerns offer less scope for using the training received at SENAI.

Be this as it may, the large firms receive a disproportionately large number of SENAI graduates. In practice, therefore, SENAI strengthens the competitive ability of the large companies. The desirability of favoring the larger firms cannot be demonstrated by purely technical or scientific arguments. By contributing to SENAI but making less use of its graduates, the medium-sized firms once again find themselves at a disadvantage in the Brazilian industrialization process.

The backdrop to the entire analysis contained in this study is the preparation of the labor force needed by Brazilian industry. We have explicitly dealt with the question of training from the point of view of industrial growth and technological progress. It was not our aim to enter into any direct discussion of employment levels or of the use of resources to meet the needs of those who are at a relative disadvantage on the labor market. The fact is that the potential SENAI student body consists of a group who, though always manual workers, undoubtly constitute a blue-collar elite.

Compared to other dynamic sectors of Brazilian education, SENAI and its offshoots represent a highly favorable allocation of resources in terms of the social group they serve. And insofar as its contribution to productivity is concerned, this investigation has yielded revealing results. Nevertheless, we must advise the reader not to attempt any comparison between SENAI and the courses of the kind typically financed by PIPMO owing to the differences in approach. Our investigation suggests that PIPMO graduates do not as a rule have to such good jobs as SENAI graduates. On the other hand, the objectives of PIPMO are different and, judged on its own merits, the program might come out ahead of SENAI.

In our inquiry in Rio de Janeiro we noted a total of 28 persons taking correspondence courses. We had not, in fact, expected to find more than this. Nevertheless, it is regrettable that a mode of education so well suited to the situations described should remain neglected. A serious objection to correspondence courses is that daily contact with the school system is a vital factor in the basic educational process. This explains the extremely high dropout rates shown for correspondence courses almost everywhere in the world. Yet education by correspondence appears to have great potential among people already holding jobs but needing additional training.

It would be a mistake to treat the manual-worker class or the lower class as homogeneous. Our investigation suggests that there is a substantial barrier between the skilled and the unskilled occupations, in terms not only of wages but also of access. In the firms we studied in Rio de Janeiro, only about 10% of the labor force began their working lives as unskilled manual workers; the other 90% or so started out in jobs with built-in prospects of progress or promotion.

This suggests that the first job is of crucial importance. To start out right appears to be essential to the worker. What determines this first job? Fate? Chance? Knowledge? The patience to wait for the right opportunity? Our investigation has shown beyond doubt that, apart from these factors, vocational courses have an immense influence on the destiny of the trainee. But this leads us to another question: what determines the amount or the type of vocational training the worker receives? His social position has much to do with this, as does the extent of his information as to which courses to take and at what point in his life. A condition for access to SENAI courses is a level of education and intelligence reached by only about 3% of Brazilians at the corresponding age. Since the middle and upper classes are not interested in these courses, the student bodies consist largely of the sons of overseers and skilled manual workers.

## 8.4 — Specialized Training May Not Be Specializing Training

One of the most surprising findings of this investigation was that, at the level of manual-worker training, the SENAI-type vocational training courses, with their highly specialized didactic format, produce workers capable of successfully performing functions quite far removed from the ones for which they were trained. The fact is that SENAI-type graduates show a greater tendency to change occupations than persons who have completed only the elementary

or lower secondary (or even upper secondary) cycles and learned their trades on the job. This fact destroys the myth that specialization at this level heightens the inflexibility of the labor force. The occupational changes made by SENAI trainees cause certain people much concern. In fact, these changes indicate the trainees' flexibility and adaptability, and not SENAI's ineffectiveness in dealing with the frictions and conflicts of the labor market.

This greater adaptability appears to derive from the fact that our school system was not designed for children of the lower class, with their different world and different language patterns. Occupational flexibility results from the understanding of general principles which in their own special language — the language of science — are inaccessible to these children.
The SENAI-type courses offer, as an alternative, a minutely detailed sequence of operations. In handling tools and materials, the students little by little come to absorb the general principles intuitively.

## 8.5 — The Organization of Training, and Related Theories

The usual theories about the organization of training — whether in-service or other training — appear to diverge substantially from our own observations during this study. Except for certain basic concepts, the theories of C. Becker and J. Mincer appear to have little relevance in explaining the behavior of our firms.

Nevertheless, a careful examination has revealed coherent patterns in training and vocational education. Contrary to what theory would lead us to expect, the relationship between the structure and character of the training program on the one hand, and wage levels on the other, is rather nebulous. The main inducement to train is the lack or scarcity of personnel with the needed skills. Once the worker has been trained, the enterprise pays what is necessary to keep him. However, there is no indication that the enterprise passes the cost of the training on to the worker, or that the worker, because he has been trained, has to defer his entry into the labor market.

On-the-job training involves significant costs for the firms only when it is necessary to train a large proportion of the labor force simultaneously. Above a certain threshold, this type of training becomes more expensive than formalized classroom training, thereby justifying the establishment of in-service courses.

# EMPLOYMENT VARIATIONS IN THE SERVICE SECTOR *

*Wanderly J. Manso de Almeida*

## 1 — INTRODUCTION

The qualification of labor acts as a significant conditioner in promoting tertiary employment in Brazil, a fact that shall become stil more evident as the economy grows. Nonetheless, in specialized literature two other important factors are commonly cited to explain the employment level in services. The first of these is the degree of industrialization, generally defined by the share of the sector in total domestic product. A higher degree of industrialization should imply a greater demand for services and a subsequent rise in the tertiary product and absorption of labor. The second is the degree of urbanization, usually defined by the urban percentage of the total population. A higher degree of urbanization should cause or be accompanied by an addition to tertiary labor force, principally in those branches demanding less qualified manpower, thus characterizing the service sector as one that absorbs "residual" urban labor. The research presented herein partially supports such opinions; however, it also shows that the qualification of labor is the most relevant factor in explaining the share of services in the total Brazilian labor force.

For a better understanding of the economic context, the following section, based on previous studies, [1] provides a general

* The main analyses for this article were taken from W. J. Manso de Almeida, *Serviços e Desenvolvimento Econômico no Brasil: Aspectos Setoriais e Suas Implicações,* Relatório de Pesquisa, n.º 23 (Rio de Janeiro: IPEA/INPES, 1974).

1 Special reference is made here to W. J. Manso de Almeida and M. da Conceição Silva, *Dinâmica do Setor Serviços no Brasil: Emprego e Produto,* Relatório de Pesquisa, n.º 18 (Rio de Janeiro: IPEA/INPES, 1973); and Manso de Almeida, *Serviços e Desenvolvimento.*

survey of tertiary activities in Brazil. To explain the relative importance of services in the Brazilian labor force, a variance analysis was applied, with the educational level of the workers, the degree of regional urbanization and the degree of regional industrialization being taken as explanatory variables. In section 3 the expected effects of these variables are discussed, and in section 4 the results of the analysis are presented. In section 5 some additional observations are made in an effort to complement the the analysis of the relationship between the industrial and service sectors, while a summary of conclusions is presented in the final section.

## 2 — BRIEF SURVEY OF THE SERVICE SECTOR

In Brazil, the service sector is responsible for the most significant portion of the domestic product and for a large part of the total labor force: respectively, nearly one-half and one-third of these aggregates in the last few years.[2] Nevertheless, this important dimension of the Brazilian service sector reveals an economy that is still in a relatively low stage of development, given the small share of industry in the generation of income and in the absorption of available labor, as well as the highly traditional nature of the bulk of tertiary activities. More than one-third of the sectoral labor force is occupied in "trading of food products and street markets", "making and repairing of wearing apparel" and "personal domestic services". However, the highest indexes of sectoral growth are registered in the least traditional branches ("Real Estate and Securities", "Liberal Professions" and "Social Activities"), which indicates a trend to modernity more in keeping with the new phase of development toward which the country is heading. That such a trend exists seems to be supported by the

[2] Unless otherwise indicated, the statistics cited herein referring to the labor force were obtained from the Fundação Instituto Brasileiro de Geografia e Estatística — FIBGE, *Censo Demográfico de 1970*, 1973, while the data on products and prices are based on FGV, *Conjuntura Econômica* 25, n.º 9 (September 1971), various pages.

The service sector is here defined as the set of activities of "Commerce" (wholesale and retail trade), "Personal Services" (including personal domestic services, hotels, laundry and cleaning services, auto and equipment repair), "Transportation, Communications and Warehousing", "Social Activities" (such as private and government schools, hospitals, and welfare services), "Public Administration" (including military organizations), and "Other Activities" (including finance, real estate and insurance). The sector does not include the so-called public utility industries or the construction concerns.

behavior of relative prices, which have not evolved favorably for the more traditional branches in the last 20 years.

On other hand, a regional approach to the product and labor force aggregates shows a strong concentration of the tertiary activities in the Southeast of the country, a characteristic which has also been noted in studies of other aspects of the Brazilian economy. This region accounts for about 65% of the total tertiary product and about 57% of the sectoral labor force, thus greatly influencing the national average indexes. In this context, the Northeast, though among the less advanced regions the one that has received the most attention in government regional economic development policies, has not experienced an appreciable improvement in its relative position either in the generation of domestic income (total and of the service sector) or in the absorption of tertiary labor. As a result, concentration of tertiary activities still seems to be advancing in favor of the two richest regions of the country — and particularly in favor of the state of São Paulo. Nonetheless, the modernizing of the occupational structure of the service sector observed at the national level is also evident in all five greater regions. This feature not only suggests progress, but also implies new restrictions on the use of available manpower.

It happens that the labor force engaged in the more modern and dynamic service activities (i.e., those experiencing more rapid growth) has a markedly higher degree of formal instruction than the workers employed in the traditional tertiary branches — a fact which should reflect the characteristics of demand. The proportion of persons in "Social Activities", "Real Estate and Securities", "Liberal Professions" and "Public Administration" who have a secondary (junior high or high school) or university education is between 25% and 50%, while for the primary and secondary sectors these indexes are about 3% and 6.3%, respectively. In addition, these more dynamic tertiary activities employ, as a whole, 62% of the manpower having a secondary education and 72% of that having a university education.

Considering the historical trends in Brazil, as well as the experience observed in countries considerd fully developed today, one can anticipate, for the long run, a continuous decline in the relative importance of the more traditional tertiary activities. Since it is in these activities that the labor force shows the lowest indexes of formal education, the possibilities for increased employment in the service sector (and, certainly, in the urban framework) should be conditioned by the availability of better educated or more skilled workers. Doubtless, it is a question of a relatively scarce factor in the country, for less than 10% of the

labor force has a secondary or university education. It is true, however, that the degree of education constitutes only one index of the qualification of labor, and it does not necessarily mean better technical and professional preparation of individuals for the jobs for which they apply or are hired. Yet, a sectoral cross-section analysis of this aspect of qualification reveals discrepancies significant enough to distinguish services, the sector to which is commonly attributed the trait of perennial absorber of "residual" urban labor. Without completely refuting this opinion, one should remember that the tertiary activities that generally employ less skilled workers (i.e., with a low degree of education) show a decreasing share in total labor force as the economy develops, in spite of the fact that they still absorb the most significant portion of the sectoral manpower.

On the other hand, the statistics also show that the underutilization of labor is significant even in those activities that should demand highly qualified workers, a resource considered scarce in the country. In the "Social and Liberal Professions", the underemployment rate is more than three times higher than in the industrial sector, and in the branch of "Personal Services" this discrepancy rises to almost four times.[3] Data on the three principal greater regions of the country (South, Southeast and Northeast) show that approximately 7% of the "Social and Liberal Professionals" employed part-time desired to work 40 hours or more per week, while in industry this index was about 2%.[4] Likewise, according to the 1970 demographic census data, approximately 45% of the personnel occupied in "Social Activities" work less than 40 hours a week compared to only 6% in the secondary sector. The regional approach of the statistics further shows that underutilization of labor is considerably higher in the Northeast than in the other regions, even in the more dynamic branches that should require greater qualification or a higher level of formal instruction.

Thus, a paradox exists in the Brazilian employment situation: a growth trend in the demand for resources considered scarce, together with a high degree of underutilization of these same factors. Explanation of this paradox seems to lie in the tradition of half-time work imposed on some tertiary activities,[5] as well as in the still subsidiary nature of the participation of women in the Brazilian labor market.

[3] This information is based on FIBGE. *Pesquisa Nacional por Amostra de Domicílios (PNAD)*, Doc. GEPED, nos. 46 to 50 (January-March 1970), various pages.

[4] *Ibid.*

[5] See Manso de Almeida, *Serviços e Desenvolvimento.*

This leads to the conclusion that there is a great loss of relatively scarce resources in the country, implying a high social opportunity cost, since the greatest expenditures on education per person (in the macroeconomic sense) are being made for a group that shows low participation in the market (in terms of regular work), or which is greatly underutilized. At the same time, the existence of underemployment imposes a significant restriction on the reduction of the overt unemployment rate.

The sectoral characteristics noted in this brief discussion should be kept in mind for a better understanding of the analysis presented in the following paragraphs.

## 3 — THEORETICAL ISSUES

To explain the relative importance of services in the Brazilian labor force, a variance analysis was applied, in which the educational level of the workers, the degree of regional urbanization and the degree of regional industrialization were taken as explanatory variables.

The influence of the degree of industrialization on tertiary employment needs to be well qualified beforehand, in order that the expected relationship be established with accuracy. To many, for example, it seems obvious that an increase in the quantities produced in industry necessarily leads to an increase in transportation and warehousing activities. In fact, what inevitably occurs is that the demand for transportation and warehousing services increases; and if enough idle capacity is available, this might be satisfied by intensifying the use of the factors already employed, in which case slight or no change will be found in the size of the labor force in the branch. There is no doubt that adequate consideration of this relationship requires that the actual use of the factors employed be measured both before and after the change in demand. Yet, it is the very absence of such correction that has led some economists to predict that an increase in other activities will necessarily affect the absorption of tertiary labor, as measured in number of persons.

Moreover, it must be remembered that this is basically an approach from the point of view of production. The response of the supply, and therefore the rhythm of tertiary activity, are being discussed only as effects of changes in the demand of the other productive sectors. That is, what is being dealt with is by nature a question of intermediate consumption; consequently, one must consider its share in the overall demand for services. It is possible

that even in those tertiary branches most closely related to industrial and/or agricultural activities, the relative importance of consumer demand is appreciable enough to impose a behavior which may be different from that indicated by the sectoral interrelations. Once again, a correct examination of the problem would require a detailed enough breakdown of the data to provide a measure for the variations in the tertiary activities that actually occurred as a result of the changes in the demand of the other sectors. This question concerns the definition of the variables that should be considered, and not the establishment of the causal relationship that might exist. It could be argued that the statistical analysis itself should select the share explained by each of the variables considered. However, the aggregation of the initial data could introduce a bias that would not be revealed by statistical tests; for example, if the variations in the final and intermediate demands exercised similar effects on the tertiary activity, a regression analysis between such effects and the variations that occurred *in only one* of the demands might provide an erroneous idea of the actual degree of dependence.

At the same time, the available statistical information may not be consistent enough for an overall analysis of the explanatory factors chosen. In this case, one must choose between (1) using the most suitable data for a given variable, and consequently restricting or excluding other factors, and (2) using less precise statistics that enable one to adopt a broad approach to the problem. For the present study, the latter alternative was adopted. "Transportation, Communications and Warehousing" were therefore aligned with "Commerce" and "Real Estate and Securities, Credit, Insurance and Capitalization" as the tertiary branches most closely related to industrial activities.

It is also necessary to bear in mind the interdependence of the degree of industrialization of a region and the supply of social services (such as education and medical care) and public administration (mainly the services linked to tax collection). An investigation based on regional indexes for the Brazilian economy, such as the analysis that will be presented in this study, tends to demonstrate such dependence, since the most industrialized regions of the country are also those in which the other activities are concentrated and in which social and public service infrastructure is better. Nevertheless, it must first be asked if the results provided by this type of analysis indicate a causal relationship or simply a parallel variation of the related variables.

Similar care should be taken when appraising the results of analysis of dependence between tertiary employment and the

degree of urbanization. According to current opinions, the growth of the urban population is accompanied by a labor force increase that is more pronounced in the service sector and in construction than in the manufacturing industries, given the limited capacity of the latter to generate new jobs. Moreover, consisting largely of migrants with a low degree of qualification, such an increase in the urban labor contingent mainly affects the more traditional activities of "Commerce" and "Personal Services", in addition to construction. These would be the "marginal occupations" that would absorb "residual labor", or rather, that would employ those laborers who did not find work opportunities in the modern industrial activities offering higher average pay. Likewise, this would indicate the existence of an underemployed contingent (or of "hidden unemployment") which would grow *pari passu* with the rising degree of urbanization, thus characterizing the service sector in Brazil.

In the present study this thesis is partly confirmed. However, one should take into account two observations concerning the expected relations. The first refers to the fact that the larger urban centers are also the most prosperous in the country; it is in these centers that the more intensive sectoral interdependences are found, in addition to better social services and public administration. This suggests a dependence between the degree of urbanization and employment in "Social Activities" and "Public Administration". Such dependence constitutes the basic argument of the second observation mentioned above. The growing urbanization of a population is accompanied, as a rule, by a decrease in the relative importance of primary activities, by a rise in the monetization of the economy, and by the greater possibility of meeting social demands, thus implying an increase in the demand for more modern services. The long-term prospect would therefore indicate a decline in the relative importance of the more traditional services in total product and in the absorption of labor, as is suggested by international statistics and by the historical trend observed in Brazil. [6] As a consequence, the employment possibilities for nonqualified (or "residual") urban labor are conditoned, *ceteris paribus,* by the very growth and modernization of the economy.

Education as an index of the qualification of labor forms the third explanatory variable in the study of the labor force in services. Its importance in this respect is due to the very transformation of the occupational structure of the service sector:

[6] This aspect is examined in detail in Manso de Almeida and Silva, *Dinâmica do Setor Serviços.*

the more dynamic branches are also the ones that absorb the greater proportion of individuals having higher education. However, certain aspects of the expected relationship should be clearly established at this point.

A variance analysis does not indicate the causal direction of the relationship. This question must be resolved a priori by theory and by auxiliary investigations. In the present case, an examination of the characteristics of tertiary labor and of the evolution of the occcupational structure shows that an increase in the share of services in total product and employment involves different demand increases for different categories of labor; and this additional demand is more pronounced for the categories of higher degrees of education. [7] The interpretation adopted here is that the explanation given by education in the analysis of the tertiary labor force demonstrates not that the greater or lesser qualification of labor causes an increase or decrease in sectoral employment, but, almost inversely, that the expansion (or retraction) of this employment requires more (or less) qualified manpower.

As to the sign of the relationship, it is of interest to consider each branch of activity separately, taking regional aspects into account. For any of the six principal service subsectors for which statistics are provided in the 1970 census, [8] it can be observed that a rise in the average schooling of manpower is accompanied by an increase in the share of the subsector in total labor force. [9] An examination of these two indexes, based on the representative regional averages, furnishes additional information as to the sign of the relationship. A cross-section analysis between the average schooling of the tertiary labor and the share of the sector in total labor force, using data for the 10 subregions defined in the 1970 demographic census, revealed a positive correlation between the two variables. That this positive relationship is verified even for the traditional activities of "Personal Services" suggests that the degree of qualification required is higher in the larger urban centers.

On the other hand, the observations made in these last paragraph point to a problem that should be avoided when selecting and measuring the representative regional indexes for the application of a cross-section analysis. The difficulty is related to the concentration in the Southeast of population and economic activity.

[7] Further details are provided in Manso de Almeida, *Serviços e Desenvolvimento*, especially sections 2.1 and 2.3.

[8] The class "Other Activities" includes, however, a portion of the labor force that is not tied to the service sector.

[9] See Table 1.

## Table 1

*Average Percentage Share of Services in Total Labor Force by Regional Groups Classified According to Three Explanatory Variables, 1970*

| Activity and Regional Group | Variable | | |
|---|---|---|---|
| | E | U | I |
| Total Service Sector | | | |
| Group 1 | 26.80 | 29.17 | 29.22 |
| Group 2 | 40.96 | 49.60 | 49.47 |
| Commerce | | | |
| Group 1 | 7.00 | 7.19 | 7.12 |
| Group 2 | 9.72 | 11.09 | 11.24 |
| Personal Services | | | |
| Group 1 | 7.47 | 8.18 | 8.46 |
| Group 2 | 11.73 | 14.34 | 13.69 |
| Transportation, Communications and Warehousing | | | |
| Group 1 | 2.94 | 3.06 | 3.09 |
| Group 2 | 5.36 | 5.90 | 5.83 |
| Social Activities | | | |
| Group 1 | 3.72 | 3.95 | 3.90 |
| Group 2 | 5.94 | 6.14 | 6.26 |
| Public Administration | | | |
| Group 1 | 2.96 | 3.32 | 3.16 |
| Group 2 | 6.04 | 5.21 | 5.58 |
| Other Activities | | | |
| Group 1 | 3.41 | 3.47 | 3.49 |
| Group 2 | 5.60 | 6.92 | 6.87 |

Source: Data based on FIBGE, *Tabulações Avançadas do Censo Demográfico*, 1970, 1971, various pages; and FGV, *Conjuntura Econômica* 25, n.º 9 (September 1971), various pages.

Code: E = Average education of the labor force in the activity, in years of study.
U = Degree of urbanization of the region.
I = Degree of industrialization of the region.

Note: Group 1 = Regions in which the variable assumes a value lower than the general mean.
Group 2 = Regions in which the variable assumes a value higher than the general mean.

In this context, a classification of the 10 subregions [10] by degree of industrialization, given by the industrial product to domestic product quotient or by the industrial labor to total labor force ratio, demonstrates that only the states of São Paulo and Rio de de Janeiro are above or near the national average, while the remaining subregions are grouped at the other extreme of the distribution.

This disparity in the regional indexes tends to bias the statistical analysis, making it necessary to adopt a measure which does not depend on classification at the national level. For present purposes, four greater regions were defined (North/ Central-West, Northeast, Southeast and South). Then each subregion was classified according to whether its degree of industrialization was above or below the average degree for the respective greater region.

This problem also appears in the distribution of the regions by degree of urbanization, given by the urban percentage of the total population. However, the disparities being less significant, it was judged sufficient to differentiate three groups, based on the national average (high, medium, low urbanization) and to distribute the 10 subregions in the classes so established.

It should further be remembered that the measure of tertiary labor adopted in this analysis is the share of services in the number of persons comprising the total labor force. Therefore, the results do not refer to employed workers, but to the whole labor force. This approach was dictated by the aggregation of the available data, a fact which should not diminish the significance of the conclusions presented. In appraising the results of the analysis, special weight should be given to the influence exerted by the degree of underemployment in the relationships established.

## 4 — INDUSTRIALIZATION, URBANIZATION, EDUCATION AND THE TERTIARY LABOR FORCE: A VARIANCE ANALYSIS

The observations made in the preceding paragraphs lay the basis for an analysis of variance of the share of services in the total labor force. In this analysis, the degrees of regional industrialization and urbanization and the degree of formal education of labor are taken as factors explaining the variance observed. To this end, five

[10] These are the 10 subregions defined in the 1970 Demographic Census statistics.

degrees of education were distinguished: i) less than 4 years of study, including no formal instruction; ii) 4 and 5 years of study; iii) 6 to 9 years; iv) 10 to 12 years, and; v) more than 12 years of study. Likewise, three degrees of regional urbanization were adopted (high, medium and low), defined with respect to the national average and given by the urban percentage of the population. Two degrees of industrialization were adopted (high and low), given by the quotient industrial product to domestic product [11] and defined for each of the four greater regions (North/Central-West, Northeast, Southeast and South). Thus, a contingency matrix having 30 possible alternatives was obtained. The level of aggregation of the available statistics allowed for a maximum of 50 observations, given by the percentage share of services in total labor force.

The analysis of variance was applied to explain the relative importance of the service sector in total labor force, as well as the shares of each of its main subsectors: "Commerce", "Personal Services", "Transportation, Communications and Warehousing", "Social Activities", "Public Administration" and "Other Activities". Since preliminary tests demonstrated enough homogeneity of sample variances to dispense with logarithmic values, [12] the observations in this analysis are unadjusted percentage shares based on 1970 data.

Table 2 shows the statistical results of the analysis, making it possible to evaluate the levels of significance, while Table 3 gives the percentages corresponding to each variable (and its interactions) in the explanation of the share of services in total labor force. Two levels of significance (5% and 1%) were considered when appraising the results, and the null hypothesis was also rejected in cases where the difference (F-2) was reasonably positive. [13]

As the statistics in Table 3 demonstrate, the degree of formal instruction of labor figures as the most important factor in explaining the share of services in total labor force in Brazil. At

[11] The industrial labor to total labor force ratio provides the same classification.

[12] This is a reference to the test of the homogeneity of the sample variances, based on the criterion of M. S. Bartlett. Concerning this test, see F. C. Mills, *Statistical Methods*, 3rd ed. (New York: Holt, Rinehart and Winston, Inc., 1955), pp. 574-77.

[13] Regarding this complementary statistical criterion, the reader can consult A. E. Paull, "On a Preliminary Test for Poling Mean Squares in the Analysis of Variance," *The Annals of Mathematical Statistics* 21, n.º 4 (December 1950): 544-45; and K. A. Browilee, *Statistical Theoryl and Methodology*, 2nd ed. (New York: John Wiley and Sons, Inc., 1967), p.p. 508-509.

## Table 2

### *Statistics of the Analysis of Variance of the Share of Services in Total Labor Force*

| Activity | Explanatory Factors | | | | | |
|---|---|---|---|---|---|---|
| | E | U | I | EU | EI | UI |
| **Total Service Sector** | | | | | | |
| GL GLW' | 4 32 | 2 32 | 1 32 | 8 32 | 4 28 | 2 32 |
| F | 88.61 | 29.99 | 18.08 | 2.96 | 1 10 | 6.48 |
| F95 | 2 67 | 3.30 | 4 15 | 2.25 | 2 71 | 3.30 |
| F99 | 3 97 | 5.34 | 7 50 | 3.12 | 4 07 | 5.34 |
| **Commerce** | | | | | | |
| GL GLW' | 4 32 | 2 32 | 1 32 | 8 32 | 4 28 | 2 32 |
| F | 62 89 | 10.54 | 11 28 | 3 57 | 1.81 | 3.51 |
| F95 | 2.67 | 3 30 | 4.15 | 2 25 | 2.71 | 3.30 |
| F99 | 3.97 | 5.34 | 7 50 | 3 12 | 4.07 | 5.34 |
| **Personal Services** | | | | | | |
| GL GLW' | 4 34 | 2 34 | 1 34 | 8 34 | 4 28 | 2 32 |
| F | 120.20 | 15.87 | 4.48 | 3.89 | 1 21 | 1.49 |
| F95 | 2.65 | 3.28 | 4 13 | 2 23 | 2 71 | 3 30 |
| F99 | 3.93 | 5.29 | 7.44 | 3.08 | 4.07 | 5 34 |
| **Transportation, Communications and Warehousing** | | | | | | |
| GL GLW' | 4'32 | 2'32 | 1'32 | 8'32 | 4 28 | 2 32 |
| F | 71 15 | 20.00 | 11.61 | 4.09 | 2 15 | 3 79 |
| F95 | 2.67 | 3.30 | 4.15 | 2.25 | 2 71 | 3.30 |
| F99 | 3.97 | 5.34 | 7 50 | 3.12 | 4.07 | 5.43 |
| **Social Activities** | | | | | | |
| GL GLW' | 4 34 | 2'34 | 1 34 | 8 34 | 4 28 | 2 32 |
| F | 12.33 | 17.61 | 11.15 | 2 83 | .86 | 1.69 |
| F95 | '2.65 | 3.28 | 4 13 | 2 23 | 2.71 | 3 30 |
| F99 | 3 93 | 5.29 | 7 44 | 3 08 | 4.07 | 5.34 |
| **Public Administration** | | | | | | |
| GL GLW' | 4'40 | 2'40 | 1'40 | 8'32 | 4'28 | 2 40 |
| F | 9 45 | 12.28 | 12.17 | .87 | .34 | 8.24 |
| F95 | 2.61 | 3.23 | 4.08 | 2 25 | 2.71 | 3.23 |
| F99 | 3 83 | 5.18 | 7.31 | 3 12 | 4.07 | 5.18 |
| **Other Activities** | | | | | | |
| GL GLW' | 4 32 | 2 32 | 1 32 | 8 32 | 4 28 | 2 32 |
| F | 49.17 | 58 14 | 33.11 | 3.91 | .58 | 23.25 |
| F95 | 2.67 | 3.30 | 4 15 | 2.25 | 2.71 | 3.30 |
| F99 | 3.97 | 5.34 | 7.50 | 3.12 | 4.07 | 5.34 |

Code. E = Degree of education of labor
U = Degree of regional urbanization.
I = Degree of regional industrialization.
EU, EI and UI = Cross-effects.
GL GLW' = Number of degrees of freedom of the factor/number of degrees of freedom of the residue.
F = Calculated statistic.
F95 = F statistic at 5"_ level of significance.
F99 = F statistic at 1"_ level of significance.

Note: The EUI cross-effect is included in the residue.

Table 3

*Percentage Contribution of Each Explanatory Factor to the Total Variation of the Service Share in Labor Force*

| Nature of Variation | Total Service Sector | Commerce | Personal Services | Transportation, Communications and Warehousing | Social Activities | Public Administration | Other Activities[a] |
|---|---|---|---|---|---|---|---|
| E | 70.73 | 71.82 | 82.70 | 69.67 | 33.10 | 26.61 | 43.14 |
| U | 11.97 | 6.02 | 5.41 | 9.79 | 23.64 | 17.29 | 25.51 |
| I | 3.61 | 3.22 | .76 | 2.84 | 7.48 | 8.57 | 7.26 |
| EU | 4.72 | 8.15 | 5.31 | 8.00 | 15.21 | h | 6.87 |
| EI | h | h | h | h | h | h | h |
| UI | 2.58 | 1.66 | h | 1.85 | h | 11.60 | 10.20 |
| Explained | 93.61 | 90.87 | 94.18 | 92.15 | 79.43 | 64.07 | 92.98 |
| Residue[b] | 6.39 | 9.13 | 5.82 | 7.85 | 20.57 | 35.92 | 7.02 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Note: h = null hypothesis accepted.

[a] Including persons looking for work for the first time, persons without a declared activity and/or not included in the other activities distinguished plus those in "Liberal Professions" and "Real Estate and Securities, Credit, Insurance and Capitalization".

[b] Including the percentage corresponding to the EUI cross-effect, for which the null hypothesis was always accepted.

the same time, it can be noticed that the percentage accounted for by this variable is significantly high in the traditional "Personal Services". In this branch, the importance of formal instruction is further stressed by the significance of the EU cross-effect, which contributes to practically the same extent as urbanization.[14] The principal reason for these results lies in the very nature of the activities and of the manpower employed. In any region of the country, "Personal Services" absorbs the greatest portion (approximately 30%) of the tertiary labor force,[15] thus implying that it is less dependent on the degree of regional urbanization. In addition, this branch generally absorbs less qualified workers, so that a rather elastic supply can be assumed, this not being a scarce factor in the Brazilian urban framework. Therefore, the labor force changes observed in the "Personal Services" subsector occur principally in the employment of individuals with formal instruction above the general average. In other words, the important contribution of schooling in explaining the labor force variations should be attributed to the inequality of the

[14] It should be noted that in the present context the cross-effects are used for greater clarification of the phenomena.

[15] Except the North, where its share is the second most important: 20%.

educational profile of the workers in this subsector. This distribution is quite concentrated in the classes with the least formal instruction, showing high coefficients of variation and assymetry. [16]

Thus, the analysis supports the thesis that urbanization is accompanied by an increase of the labor force in the traditional activities, which are characterized as absorbers of "residual" labor. The analysis also shows that this variation is mainly the result of differences in the degree of formal instruction of individuals. This conclusion is illustrated by the fact that even in "Personal Services" the average schooling of laborers is higher in the more developed regions of the country (approximately 3 years of study in the Southeast, compared to 1.8 years in the Northeast).

The degree of education is also the most significant variable explaining the labor force variations in "Commerce" and "Transportation, Communications and Warehousing" services. Nevertheless, in these branches the percentages of the total variation in the labor force accounted for by industrialization and urbanization are higher than in "Personal Services". Also, the significance of the UI cross-effect supports the thesis that the largest urban centers are equally the most industrialized, a behavior that should be accompanied by a relative increase in the tertiary labor force. Such results agree with the expected conclusions, though it should be stressed that qualification is still the most important element in explaining the share of these two branches in total labor. That is, the variation in the relative importance of "Commerce" and "Transportation" is accompanied by a variation in the degree of formal instruction higher than the variations in the industrialization and urbanization indexes. In addition, the fact that in Brazil average schooling is higher in the more urbanized regions proved important enough to determine the significance of the EU cross-effect.

The distribution of labor by degree of formal instruction appears less unequal in "Transportation" and "Commerce" than in "Personal Services": the percentage of workers having secondary or university education is two to three times higher in the first two branches than in the last. However, even in these branches the distribution is concentrated in the classes of least formal instruction: approximately 38% and 45% of the workers in "Commerce" and "Transportation", respectively. Consequently, the variation of the labor force in these activities is substantially

[16] For the distribution observed in 1970, the coefficients of variation and of assymetry of Pearson are, respectively, 101.12% and −0.52.

related to the differences in qualification of the manpower. At the same time, the distribution suggests that this relationship follows a concave trajectory, with the elementary and secondary (junior high) classes of instruction being the modes.

The expectations are also confirmed by the results obtained for "Social Activities" and "Public Administration", In these cases, the lower coefficients of variation and assymetry of the distribution of workers by degree of education determined a smaller contribution of the variable E to the explanation of the phenomenon studied. In these subsectors, the labor force is less heterogeneous with regard to qualification than in the branches previously analysed. Nevertheless, the distribution of workers in "Social Activities" and "Public Administration" is concentrated in the higher education classes. Thus, the expansion of their labor force occurs in a differentiated manner, principally favoring the demand for personnel with greater qualification. At the same time, it can be ascertained that this labor increase is closely related to the degree of regional urbanization, which accounts for 17% to 24% of the total variations observed in these branches. The dependence between the two variables is due to the fact that in Brazil the larger urban centers are also the ones having a better infrastructure of public services, which account for the greater share of the demand for labor in these two subsectors.

The relative importance of industry emerges as an equally significant factor in explaining the employment share. Its influence is more pronounced in "Public Administration" than in "Social Activities". This is further supported by the contributions of the EU and UI cross-effects. The first is statistically significant only in "Social Activities" (with a considerable contribution), while the second is significant only in "Public Administration". These results confirm the hypothesis that there is a greater demand for (or supply of) such services in the more industrialized urban centers. In these centers, "Public Administration" services are more complex owing to the greater demand for infrastructure and possibly to the very emphasis given industry in the Brazilian development policy. In contrast, "Social Services" education, medical care and social welfare) are more related to the size of the urban center, independent of the productive structure of its economy.

Finally, it should be stressed that in these two subsectors the unexplained percentage of the phenomenon is still quite considerable. This suggests, rightly enough, that the expansion of public utility services does not depend only on variables of an economic nature. In fact, if a different result had been obtained, further considerations would be needed and government authorities

advised. There are, for that matter, other relevant factors taken into account in the political decision-making process which could not be revealed in this simple economic analysis.

As to "Other Activities", the explanations obtained are similar to those noted for the service sector as a whole. Since, due to aggregation of the data used, this group includes some categories of labor that are not necessarily tertiary, it is difficult to make a definite evaluation of the statistical results. Yet, in this group of laborers are classified those in "Real Estate and Securities, Credit, Insurance and Capitalization" and "Liberal Professions", branches in which the labor force shows high average schooling. In addition, these activities are more dependent on the relative importance of the urban center, and such relative importance is accompanied by more intensive sectoral interrelations. This fact seems to have been of sufficient weight to determine the significances and the expressive contributions of the urbanization and industrialization variables of the UI cross-effect in explaining the behavior of the labor force in the group "Other Activities" as a whole.

Throughout this appraisal, it is necessary to keep in mind the influence of the very intervals of variation of the explanatory factors E, U and I, intervals which were determined by the classification adopted. Industrial activities are still highly concentrated in the Southeast of the country, and particularly in the state of São Paulo, whose share in total product is far above the national average.

In the other regions, the share of industry in total product is appreciably lower.[17] As should be recalled, it was this situation that determined that the subregions be classified relative to the average degree of industrialization of each greater region adopted Even so, it was only possible to distinguish two degrees of industrialization. Thus, the regional bias was eliminated, but to the detriment of the interval of variation of the explanatory factor. This restriction appears less important in the distribution of the subregions by relative degrees of urbanization; nevertheless, there is still a smaller interval than that corresponding to the education variable. It can be argued that these are characteristics of the Brazilian economy and should be treated as such. Although the proposition is strong, it was decided to adopt it only partially in this analysis of variances, the results of which should be considered more for the significance of the variables

17 São Paulo is the only state for which the industrial product to domestic product ratio is higher than the national average.

than for the percentage that each contributes to explaining the phenomenon.

It seems quite clear that the degree of education is the weightiest factor in explaining the service share in total labor force; yet the other two variables also proved significant, especially in the more modern and dynamic activities of the service sector. The combination of these three explanatory factors therefore suggests that the Brazilian economy, with its growing urbanization and industrialization, will experience a differentiated growth of its tertiary activities and, consequently, a greater increase in the demand for labor possessing a high degree of education or qualification.

## 5 — INDUSTRY AND SERVICES: FURTHER OBSERVATIONS

Two aspects call for special consideration in the analysis of dependency between the degree of industrialization and the share of services in total labor: the greater relative underutilization of the factor in services, and the importance of the personnel not directly connected to production in total industrial employment. Both should be partly responsible for a lesser contribution of the variable I in explaining the share of the tertiary sector in total labor force. In the first place, the existence of idle capacity in the tertiary activities tends to lessen the effects caused by the variation in industrial demand. That is, an increase in the industrial product and/or employment, causing an increase in the demand for complementary services, is not necessarily followed by greater opportunities for tertiary employment if factor underutilization prevails. Insofar as the increases in demand can be satisfied through more intensive use of the manpower already employed, no variation in the labor force of the service sector will be registered. This situation should imply a lower relevance of the degree of industrialization in explaining the share of services in total labor.

In the second place, the varying characteristics of organization and of operation of the different industrial enterprises determine different effects on the most closely related tertiary activities. A large number of services are generally produced in the very sphere of industry, and the importance of this output, both absolute and relative, appears to vary from enterprise to enterprise and among the various branches. These commonly include, among others, general administration and

control, planning and programming of sales, marketing and distribution of products (that is, sales and transportation), advertising, research and development of new methods, techniques and products, and feasibility studies. Some of these services, perhaps the majority, could hardly be obtained efficiently and promptly outside the industrial unit itself. However, there is a second portion that could be (and often is) contracted from firms specialized in the rendering of such services. Marketing, distribution and advertising, as well as feasibility studies, planning, and inspection of the facilities being expanded, are good examples frequently encountered in the Brazilian economy itself. However, these possibilities are probably conditioned by the size of the industrial enterprise, aside from the preferences and guidelines adopted by each firm and the inelasticities of supply in the service sector itself (which may not be adapted to the type of demand).

Thus, to the extent that industrial expansion is accompanied by greater "internal" production (i.e., within the enterprises themselves) of the related services, the effects of industrialization on the tertiary absorption of labor will be only partly captured by the statistics adopted here. In fact, workers classified by occupation would be the most suitable information for the analysis, but it would have been impossible to explicitly introduce this type of data into this research without excluding other important variables. This being the case, the smaller contribution provided by the degree of industrialization in explaining the share of services in total labor force is also partly due to the "internal" production of services by industry.

An examination of the labor composition in the various manufacturing branches illustrates and supports this proposition. In Table 4 are listed the 21 main manufacturing industries, together with the respective personnel (as percentage of total employment) not directly connected to the productive process. For a greater number of these branches, the share of nonproduction workers in total employment continuously decreases in the interval defined by the classes of enterprises employing less than five persons and 50 to 99 persons.[18] However, above this class the share follows a stable growth trend in most of the manufacturing branches,[19] as shown in Table 4. At the

[18] The most important exceptions are in "Chemicals", "Pharmaceuticals", "Beverages" and "Publishing and Printing", in which the percentages rise continuously starting from the classe of firms employing five to 19 persons.

[19] In this case, the exceptions are provided by the continuation of the decreasing tendency in "Textiles" (to the last size class), "Food Products" and "Tobacco" (to the class of firms employing 250 to 499 persons).

Table 4

*Average Percentage Share of Nonproduction Workers in Total Employment in Industry, 1969*

| Industry | Class of Enterprise by Number of Employees | | | i (Relative Numbers) |
|---|---|---|---|---|
| | From 50 to 99 | 1 000 and More | All Classes | |
| 1 *Dynamic Industries* | | | | |
| Electrical and Communications Equipment | 17.9 | 20.8 | 21.1 | 1.09 |
| Transport Equipment | 17.1 | 32.8 | 26.5 | 1.37 |
| Nonelectrical Equipment | 18.9 | 29.5 | 23.3 | 1.20 |
| Chemicals | 28.5 | 30.5 | 26.9 | 1.39 |
| Pharmaceuticals | 48.4 | 53.0 | 47.8 | 2.46 |
| Cosmetics, Soap and Candles | 38.2 | 26.5 | 39.8 | 2.05 |
| Plastic Products | 15.0 | 20.1 | 18.4 | .95 |
| Paper and Cardboard | 13.4 | 13.9 | 15.9 | .82 |
| Rubber | 14.5 | 12.0 | 15.6 | .80 |
| Metallurgy | 15.0 | 18.7 | 17.5 | .90 |
| Nonmetallic Minerals | 12.6 | 16.0 | 15.4 | .79 |
| 2. *Traditional Industries* | | | | |
| Furniture | 16.6 | 19.4 | 17.5 | .90 |
| Publishing and Printing | 21.2 | 43.8 | 28.5 | 1.47 |
| Tobacco | 14.3 | 15.3 | 16.3 | .84 |
| Cloting, Footwear and Textile Products | 11.6 | 12.3 | 12.6 | .65 |
| Wood Products | 10.1 | 31.7 | 13.0 | .67 |
| Food Products | 21.9 | 28.9 | 22.2 | 1.14 |
| Beverages | 35.9 | 23.0 | 34.0 | 1.75 |
| Textiles | 12.4 | 8.0 | 9.5 | .49 |
| Leather Products | 10.8 | 6.6 | 12.0 | .62 |
| Miscellaneous | 16.0 | 25.3 | 20.2 | 1.04 |
| Total Manufacturing Industry | 17.0 | 21.7 | 19.4 | 1.00 |

Source: Data obtained from IBGE, *Produção Industrial*, 1969, pp. 44-53; and E. L. Bacha *et al.*, *Encargos Trabalhistas e Absorção de Mão-de-Obra*, Relatório de Pesquisa, n.º 12 (Rio de Janeiro: IPEA/INPES, 1972), p. 168.

Iode i = Ratio between the average for each branch and the overall average for manufacturing industry. (This corresponds to the "non-operative labor intensity index" of P. Galambos).

same time, the percentage of nonproduction workers in total employment is generally higher in the dynamic industries (that is, those that have shown the highest growth rates in real output) than in the traditional ones. In the first group, this percentage is particularly high for "Pharmaceuticals", "Cosmetics" and "Chemicals", while in the latter the percentage stands out for "Beverages", Publishing and Printing" and "Food Products".
In this context, two facts must be taken into account. The first is related to the influence of "fixed administrative costs", which decrease per unit produced. This should be reflected in the continuous decrease observed in the percentage of nonproduction labor in the first classes of enterprises. This economy of scale becomes less significant as the size of the firms goes beyond a certain class. At this point, the organizational complexity begins to require a growing share of nonproduction workers. Moreover, it is precisely at this point that a new fact should be considered: the possibility of more intensive use of capital. The smaller enterprises would not only have a higher fixed cost per unit, but would also be characterized by less standardized methods of production — which require a lower capital to labor ratio. The enterprises that are larger and characterized by mass production, by adopting more capital-intensive techniques, would tend to "release" direct production labor (as compared to the smaller firms). This should result in a greater share of nonproduction workers in total employment. Remembering the natural organizational divergencies among the firms and manufacturing branches, such are the characteristics indicated by the statistics in Table 4.

At the same time, these observations clearly suggest that the relative substitution of capital for labor occurs mainly at the level of production, i.e., the substitution is mostly of production workers by equipment. This proposition, perhaps largely foreseeable, has not always been taken into account in recent discussions on employment.[20]

Thus, at leats two industrial growth trends should be distinguished with reference to their effects on tertiary employment: a) an increase in the proportion of nonproduction workers in total industrial labor as a consequence of greater capitalization of production activities, and b) an increase of this proportion as a result of the expansion of the enterprises and greater administrative and organizational complexity. The latter trend

20 On this proposition and related subjects, see Ida R. Hoos, "The Impact of Office Automation on Workers," *Revue International du Travail* 82, n.º 4 (October 1960): 363-88.

could imply greater production of services within the industrial units. And, if so, only this trend will lessen the effects of industrial expansion on the activities of the service sector. However, it is precisely the greater complexity of industrial organization that should be responsible for creating new demands for services (and even service activities). After reaching a certain size, which varies from branch to branch and among firms, the industrial enterprises begin to look beyond their sphere for the provision of specialized services.[21]

## 6 — FINAL CONSIDERATIONS

This study has shown that formal instruction of individuals is significantly related to the share of the service sector in the Brazilian labor force. This relationship appeared quite important in all the tertiary subsectors, and demonstrated that education is the most relevant explanatory factor in the variance analysis made.

Also based on previous research, the conclusions of which were presented here in the form of a brief sectoral survey, this dependency relationship was interpreted as a strong indication that the increase in the labor force in services requires an increase in the average schooling of individuals, which represents a measure of the qualification of labor. This diagnosis is valid even in dealing with the more traditional "Personal Services", in spite of the rather common opinion that it is in this subsector that one finds the greatest portion of the "residual" urban labor force.

Considering the growth rates of labor absorption in the various tertiary branches, a rising demand for more qualified workers will gradually show in the market, and this will impose greater restrictions on the future promotion of employment in the urban picture. In this way, labor qualification emerges as an indispensable instrument in a policy for increasing work opportunities, even in dealing with the service sector, to which

[21] For a similar (and more complete) study applied to the British case, see P. Galambos, "On the Growth of the Employment of Non-Manual Workers in the British Manufacturing Industries, 1948-62," *The Bulletin of the Oxford University* 26, n.º 4 (November 1964), in which pages 371-72 read: "The industry groups for which non-operative labor intensity is consistently equal to, or exceeds unity are 'Chemical and allied industries', 'Engineering and electrical goods', 'Paper, printing and publishing' and 'Vehicles' (apart from 'Other manufacturing industries'). These groups include new expanding industries where development, research, financial and stock control, more scientific production planning and other organizational activities are likely to occupy a substantial proportion of non-operative staff".

has been attributed the false trait of perennial absorber of nonqualified workers.

This study has also demonstrated that, in accord with general current opinion, the degree of regional urbanization is a significant variable in explaining the share of services in total labor. It was further observed that a larger urban center requires a greater working contingent in modern tertiary activities, which should demand more qualified workers (or manpower having a higher degree of formal instruction).

As to the relationship between industrial activities and employment in related services, the analysis has shown that this dependence also occurs in fields that are usually not considered by researchers, such as "Social Activities" and "Public Administration". On the other hand, it was observed that the significance of the degree of regional industrialization as a factor explaining the share of services in total labor is reduced due to the higher indexes of labor underutilization in the tertiary activities, as well as to the "production" of services demanded by industry in the very sphere of its units.

It may therefore be concluded that the economic development of the country, being accompanied by urbanization and industrialization and by a growing demand for various services, will render increasingly explicit the pressing need to expand educational and training services to prepare the required labor force. Though logically expected, this conclusion has often been illogically forgotten.

# FISCAL INCENTIVES FOR THE INDUSTRIALIZATION OF THE NORTHEAST OF BRAZIL, AND THE CHOICE OF TECHNIQUES *

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## 1 — INTRODUCTION

The present work analyzes the results of the fiscal incentive policy used to foster industrialization in the Northeast of Brazil and assesses its effects on the choice of technique.

The first and essential question is whether investment decisions and choice of technique in industry respond to changes in factor prices. Also considered is the possibility of revising the incentive system currently in force, with its heavy emphasis on capital subsidies, in order to promote greater labor absorption by the new industrial undertakings.

The paper comprises four parts: (i) an analysis of the fiscal and financial incentives used to stimulate new industrial activities; (ii) a discussion of the historical background of regional industrialization policy and the present existing program; (iii) an econometric analysis of the hypothesis that the choice of technology responds to changes in the relative costs of production factors (This analysis involves estimation of CES production functions using data for new industrial projects approved between 1962 and 1970.); and (iv) an examination of some general implications of industrialization policy as presently conceived and administered.

## 2 — THE FISCAL INCENTIVE MECHANISM

The body of incentive measures to stimulate private industrial capital formation in the Northeast is generally known as the 34/18 program in recognition of the central role assumed by the tax

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credit mechanism established in 1961. [1] The incentive scheme is administered by SUDENE, the federal agency created in 1959 for promoting the development of the region. SUDENE may concede tax and financial incentives to industrial, agricultural and telecommunications projects located within its area of jurisdiction. [2] This comprises nine states extending from Maranhão to Bahia as well as those *municípios* in Minas Gerais which are included in the *polígono das secas* (drought zone). The principal incentive of the 34/18 scheme resides in the fact that registered Brazilian corporations (*pessoas jurídicas*) may reduce their annual federal tax liability by 50% by opting to invest the corresponding funds in projects approved by SUDENE. Since the basic corporate income tax rate is presently 30%, this option offers significant tax savings.

This system remained in force throught the fiscal year 1970 but two recent policy iniciatives, namely PIN and PROTERRA, will bring substantial modifications. [3] Thus, in the fiscal years 1971-1974, 30% of the tax incentive funds deposited with the Banco do Nordeste do Brasil (BNB) for investment in SUDENE projects were to be appropriated automatically by PIN. [4] In addition, during the fiscal years 1972-1976, 20% of the tax credit resources arising from the 34/18 scheme were to be allocated to finance PROTERRA. Thus, with the implementation of PIN and PROTERRA, the tax credit funds effectively available to corporations as a result of their option to invest in the SUDENE area should be reduced to 25% of their annual federal tax liability. Possible consequences of the changes in the 34/18 scheme introduced by PIN and PROTERRA are ignored in the following discussion, which concentrates on the incentive system in effect before the fiscal year 1971.

1 The name derives from the legislation regulating the administration of investiment incentives by SUDENE (Superintendência do Desenvolvimento do Nordeste). That is, Article 34 of Decree n.º 3395 (December 1961), and the amendments introduced by Article 18 of Decree n.º 4239 (June 1963).

2 The area administered by SUDENE comprises nine states—Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe and Bahia—and the area of northern Minas Gerais included in the *polígono das secas* (drought zone).

3 The 34/18 mechanism had previously been extended, in some cases with substantial modifications, to the North of Brazil (SUDAM) and to fisheries (SUDEPE), tourism (EMBRATUR), reforestation (IBDF) and adult education (MOBRAL).

4 See Article 5 of Decree-Law n.º 1106 of June 1970 (Programa de Integração Nacional — PIN) and Decree-Law n.º 1179 of July 1971 (Programa de Redistribuição de Terras e de Estímulo à Agroindústria do Norte e do Nordeste — PROTERRA).

The 34/18 deposits invested in approved projects must be combined with additional resources furnished by the firms undertaking the projects (onwn capital). The relative participation of 34/18 funds and own capital in the non-loan financing of approved projects is determined by SUDENE in accordance with a point system which assigns differential weight to selected project characteristics, as described below. An intrinsic feature of the 34/18 scheme is that beneficiary firms are responsible for attracting the amount of 34/18 funds permitted by SUDENE and must negotiate the terms of equity participation with individual depositors. This participation usually takes the form of nonvoting, preferential stock, [5] negotiable only five years after the conclusion of the project. An informal system of investment brokers and consultants performing intermediary functions has emerged to facilitate the operation of this capital market in 34/18 deposits. It is important to observe that access to 34/18 financing is not restricted to firm with deposited tax savings, and any new or establisher firm with an approved project may negotiate the investment of 34/18 funds directly with depositors. In effect, these firms have a captive capital market in which they may obtain equity financing within the limits established by SUDENE.

A second powerful investment incentive, and an integral part of regional development policy, is provided by BNB in the form of long-term loans to firms with approved projects. This agency may finance, in domestic or foreign currency, up to a maximum of 50% of total project investments. Moreover, before 1969, BNB financing was available at a nominal interest rate of 12% plus 3% commision, resulting in a sharply negative interest charge in real terms given prevailing rates of inflation. The reduction in the initial amount of equity or risk capital needed to establish and industrial enterprise in the Northeast, achieved by combining 34/18 funds and BNB financing, is the principal inducement to invest offered by the tax credit scheme. For example, in the case of a project in the *A* category of SUDENE's priority classification and hence eligible to raise 75% of its total equity through 34/18 deposits, recourse to BNH financing can reduce its own equity contribution (own capital) from 25% to 12.5%.

[5] For a more detailed description of investment incentives in the Northeast, see MINTER/SUDENE, Departamento de Industrialização, *Regulamento dos Incentivos Fiscais e Financeiros: Decreto n.º 64214 (18 de março de 1969);* and *idem, Incentivos Fiscais e Financeiros para o Nordeste* (Recife, 1969).

## 3 — THE HISTORICAL BACKGROUND TO INDUSTRIALIZATION POLICY

The main guidelines for a comprehensive regional development strategy were initially formulated in the GTDN report published in 1958.[6] In 1959, at the request of President Kubitschek, GTDN elaborated these guidelines into an action plan, which was intended to orient the activities of SUDENE.[7] Industrialization was assigned a major role in the policy measures proposed by GTDN to overcome the region's underdevelopment and reduce regional disparities. For present purposes, it is worthwhile to consider briefly the main objectives which GTDN sought to achieve via accelerated industrialization. The principal justification for the establishment of an "autonomous center of manufacturing expansion" was the need to diversify the sources of regional growth and compensate for the stagnation of its traditional primary product exports, historically the main dynamic element in regional development. Without entering into elaborate detail, GTDN clearly envisaged the creation of a modern, diversified and vertically-integrated industrial sector modeled on the Center-South pattern to endow the region with an industrial system "capable of self-sustained growth". Thus, GHDN's plan specifically recommended that the following lines of industrial policy be pursued: (i) the reorganization and modernization of traditional industries, with particular attention to the case of cotton textiles; (ii) the installation of basic industries (*indústrias de base*), including a steel plant to stimulate the region's embryonic metal-working and machinery sectors; and (iii) the systematic development of industries utilizing locally-produced raw materials.[8]

Apart from the overriding aim to provide an autonomous source of growth, industrialization was also advanced as a solution to the region's grave employment problems.[9] The urgent needs to accelerate employment creation, reduce the incidence of underemployment and modify the prevailing occupational structure, characterized by the concentration of the labor force in low-productivity sectors, are recurring themes in the GTDN report.

[6] Grupo de Trabalho para o Desenvolvimento do Nordeste — GTDN, Conselho de Desenvolvimento, *O Diagnóstico da Economia do Nordeste* (Rio de Janeiro, 1958).

[7] GTDN, Conselho de Desenvolvimento, *Uma Política de Desenvolvimento Econômico para o Nordeste* (Rio de Janeiro, 1959). Henceforth, this report is denoted simply as GTDN and all page references are to the second edition, published by SUDENE in 1967.

[8] *Ibid.*, pp. 83-87.

[9] *Ibid.*, p. 53.

In this respect, it should be emphasized that GTDN explicitly regarded rapid industrial growth and labor absorption as complementary, mutually compatible objectives. Indeed, GTDN expressed its confidence in the dual function of industrialization quite categorically: "The absorption of masses of labor, at a high level of productivity, is only possible with the installation of manufacturing industry." [10] Furthermore, "for many years, the aim of the industrialization effort will be to reduce disguised unemployment in urban areas". [11] However, GTDN firmly rejected the view that industrialization could also absorb "the great excess population in the semi-arid region"; such a presumption, it argued, "fails to recognize the real nature of the problem and its magnitude". [12] GTDN therefore proposed to attack the employment issues on two fronts simultaneously: "industrialization to absorb the surplus urban population and the extension of the agricultural frontier and irrigation in arid areas to increase the supply of cultivable land." [13]

This brief summary is sufficient to reveal GTDN's preocupation with employment problems and their influence on the decision to adopt an industrialization strategy. Furthermore, SUDENE wholeheartedly endorsed the GTDN orientation and policy objectives in the early and mid-1960's. However, political and budgetary constraints impeded real progress in the implementation of the large-scale colonization and irrigation schemes proposed by GTDN, with the result that the 34/18 industrialization program has dominated regional policy in the past decade. [14]

## 4 — THE INDUSTRIALIZATION PROGRAM AND URBAN EMPLOYMENT

The broad scope of the industrialization process initiated by the 34/18 mechanism can readily be appreciated by considering several aggregative measures, Between 1962 and April 1976, SUDENE

10 *Ibid.*, p. 83. Translated from the Portuguese original. Authors' italics.

11 *Ibid.*, p. 54.

12 *Ibid.*

13 *Ibid.*

14 The draft bill containing the provisions of SUDENE's first master plan (I Plano Diretor) did not include the income tax deduction mechanism which later gave rise to the 34/18 program. This mechanism resulted from an amendment introduced in the Chamber of Deputies during the prolonged legislative struggle to gain approval of the master plan. While this amendment ensured the financial viability of the industrialization scheme, it also led to distortions of the aims originally proposed by SUDENE.

approved 418 new industrial projects,[15] involving a total investment of Cr$ 4 421 million or US$ 1 091 million at constant 1969 prices. In addition, 133 modernization projects were approved with a total investment of Cr$ 1 128 million. Direct employment creation associated with new projects, assuming full capacity operation, amounts to 73.5 thousand. The resultant capital/labor ratio is approximately Cr$ 60 185 or US$ 14 860 at 1969 prices. However, these ratios range as high as Cr$ 154 thousand in "Chemicals" and Cr$ 103 thousand in "Metallurgy". These industries account for 26% and 16% of total new project investment, respectively. Labor absorption in modernization projects amounts 33.6 thousand, but it is preferable to consider this figure as an estimate of the employment maintained by 34/18 investment rather than as a net contribution to the supply of regional employment opportunities. Despite the importance of the regional industrialization program in terms of sectoral output expansion an diversification of the productive structure, its direct contribution to reducing the urban employment *deficit* is thus an extremely modest one.

In fact, the preliminary results of the 1970 demographic census show that the urban population in the Northeast grew at a cumulative annual rate of 4.5% in the years 1960-1970. In the same period, the total population grew at the rate of only 2.5% per year. While the disparity between urban and total population growth is less marked than in the 1950's, rural-urban migration is greatly modifying the spatial distribution of the region's population and the labor force.[16] Rule-of-thumb estimates of rural outmigration give a figure of 2.1 million during the sixties, representing 28% of the urban population in 1960.[17]

Concomitantly, the urban labor force grew at an average annual rate of 4.0% between 1960 and 1970, with growth rates of 4.8% for secondary activities and 3.7% for the tertiary sector. In quantitative terms, however, tertiary activities were pre-eminent in the creation of employment opportunities, accounting for 72% of the urban labor force in 1970 and for 68% of the growth observed in 1960-1970.

15 Only projects in mining and manufacturing are considered here.

16 For a more detailed analysis of this topic, see David E. Goodman and Roberto Cavalcanti de Albuquerque, *A Industrialização do Nordeste*, vol. 1, *A Economia Regional*, Relatório de Pesquisa, n.º 6 (Rio de Janeiro: IPEA/INPES, 1971), ch. 3.

17 *Ibid.*, pp. 60-61.

The results obtained from the national household sample surveys (Pesquisa Nacional por Amostra de Domicílios – PNAD) for the last three quarters of 1969 and the first quarter of 1970 demonstrate that open urban unemployment is apparently low, averaging 3.1% of the labor force, or 100 thousand individuals.

Several items specified in the PNAD surveys can be used to analyze urban underemployment. Although this analysis departs from rigorous theoretical concepts, a pragmatic approach is required to obtain an empirical measure of urban underemployment.[18] As an initial step, two categories of visible underemployment can be distinguished. That is, individuals normally employed part-time (less than 40 hours per week) who express a preference for full-time work and, secondly, persons with regular full-time jobs who were working only part-time during the PNAD reference week. These two measures indicate that about 12% of the urban labor force is underemployed. On the basis of the 1970 census figures, these two categories of visible underemployment include about 384 thousand workers. The highest incidence of underemployment is found in services, accounting for 15% of its labor force or about 106 thousand individuals. An aggregate average for measure of urban labor underutilization, combining open unemployment and visible underemployment, embraces 15% of the urban labor force or approximately 484 thousand workers.

PNAD data can also be used to estimate disguised unemployment in the tertiary sector. For this purpose it is assumed that workers who earn less than 50% the minimum ware are underemployed. This measure covers one-third of the labor force engaged in services and about 8% of the total urban labor force. This brief discussion demonstrates that urban underemployment affected about one-fifth of the labor force, or approximately 735 thousand individuals, in 1970. It thus remains a grave social problem, despite the development policies of the past decade. The dimensions of the employment problem and the prospect of continued rural-urban migration emphasize that the need to accelerate job creation is just as crucial in the 1970's as in the late 1950's when GTDN so clearly diagnosed the situation.

If the trends observed between 1960 and 1970 continue, urban activities will need to provide employment for the 1.6 million individuals who will enter the urban labor force in the seventies.

18 The conceptual and methodological problems encountered in this analysis of urban underemployment are discussed in Goodman and Albuquerque, ch. 3.

The magnitude of the task becomes evident when it is noted that the urban sector generated about 1 million jobs in the sixties. In the seventies, it will be necessary to absorb 1.6 million workers merely to avoid a further increase in the incidence of underemployment prevalent in 1970. These comments place the 34/18 industrialization program in a wider context and emphasize its limited role in alleviating the problem of unemployment and underemployment in the urban Northeast.

## 5 — THE CHOICE OF TECHNOLOGY AND THE COST OF PRODUCTION FACTORS

### 5.1 — Nature of the Problem

Against this background, it is interesting to consider whether the observed capital intensity of new industrial projects in the Northeast is explained by the pronounced capital subsidy of the 34/18 scheme. Futhermore, can this characteristic be modified by policy-induced changes in relative factor prices? This question provides the main theme of the present paper. Apart from its purely academic interest, research along these lines may eventually assist in the reformulation of regional industrial policy in order to promote more rapid labor absorption *inter alia*.

Certainly the capital subsidies conceded by the 34/18 system have been most effective in attracting new industrial undertakings to the Northeast. It is also true that this process of accelerated industrialization would hardly have proceeded so rapidly in the absence of the powerful stimuli offered by 34/18. What we wish to ascertain, however, is the extent to which investment desicions react to changes in factor prices, and whether this would have a discernible effect on the capital/labor ratio. In other words, we are concerned with the elasticity of factor substitution. In policy terms, can the prices of capital and labor be considered as economic policy variables?

It is of interest, therefore, to analyze the choice of techniques by the new industrial enterprises being installed in the Northeast. For this purpose, we examine the hypothesis that entrepreneurial decisions respond to changes in factor prices by selecting those production techniques which will maximize profits, given the prevailing system of relative prices.

## 5.2 — The Mechanism for Financing Projects

A point system is employed to determine the participation of 34/18 financing in industrial projects approved by SUDENE. Projects are ranked in five priority categories designated by the letters *A*, *B*, *C*, *D*, and *E*. These correspond, respectively, to the following share of 34/18 financing in total project investment: 75, 60, 50, 40 and 30%. [19] Project ranking is undertaken by reference to a points system which attributes weights to a series of project characteristics. The criteria embodied in this system in 1969 are shown in Table 1. The numbers of points given for labor absorption are calculated using the formula

$$\frac{1.250}{D_*} + .025\ E \qquad (1)$$

where

$D_*$ = the ratio between total investment per man and the value of highest minimum wage in Brazil

E = the number of direct jobs created by the project

Denoting total investment as $K$, the number of direct jobs created $L$ and the highest minimum wage $w$, then equation (1), for a given number of points $Z$, may be expressed as

$$1.250\ w. \frac{L}{K} + .025\ L = Z \qquad (2)$$

If the values $K/L$ and $Z$ are established, equation (2) above will give $L$ as the solution. [20]

Assuming that the ratio $K/L$ represents the technology used, what is intended as an incentive to labor absorption becomes a stimulus to large production units since the same number of points may be obtained whatever the value of $K/L$, provided the size of the enterprise measured by $L$, is not fixed.

[19] See MINTER/SUDENE, *Incentivos Fiscais e Financeiros para o Nordeste*, p. 37.

[20] Formula (1) is that mentioned in *Incentivos Fiscais e Financeiros para o Nordeste* (MINTER/SUDENE), while formula (2) is a purely formal modification of (1). The purpose of this reformulation is simply to elucidate one of the consequences arising from SUDENE's use of the formula.

Table 1

*Point System for Determining the Financing Scheme of Industrial Projects Approved by SUDENE* [a]

| Type of Project | N.º of Points |
|---|---|
| Projects in the capital goods and basic intermediate goods sectors | 20 |
| Projects in the consumer durable goods and textile sectors | 10 |
| Projects for import substitution or export of at least 40% of total output | 10 |
| Projects having over 80% of total raw and intermediate materials purchased in the Northeast | 15 |
| Projects having over 50% of total raw and intermediate materials purchased in the Northeast | 10 |
| Projects located in Maranhão, Piauí and the Territory of Fernando de Noronha | 25 |
| Projects located in Rio Grande do Norte and Sergipe | 20 |
| Projects located in Ceará, Paraíba, Alagoas and Minas Gerais (where SUDENE has jurisdiction) | 15 |
| Projects in which the share of labor in total value added is at least 25% | 5 |
| Projects for relocation and/or modernization of existing plants to increase productivity | 5 |
| Projects with diversified equity ownership (*empresas de capital aberto*) | 5 |
| Projects having employee profit-sharing provisions | 5 |

Source: MINTER/SUDENE, Departamento de Industrialização, *Incentivos Fiscais e Financeiros para o Nordeste* (Recife, 1969).

[a] For other criteria, especially concerning absorption of labor, refer to text.

Based on the final number of points obtained, the project is than ranked in one of the five categories mentioned above as follows:

| | |
|---|---|
| 50 points or over | A |
| 40 to 50 points | B |
| 30 to 40 points | C |
| 25 to 30 points | D |
| less than 25 points | E |

Projects located in Recife, Salvador, and their respective neighbouring *municípios* are restricted to the *B* category of priority. Furthermore, SUDENE, "considering other aspects of 'essentiality', especially the type of product involved, locational factors, and the availability of Article 34/18 funds", [21] has the power to grant up to 10 additional points or deduct up to 15 points from the total number awarded to any project.

## 5.3 — The Cost of Capital

An accounting item termed "capital remuneration" is included in the project proposals submitted for SUDENE approval and is conventionally set within the range of 12% per annum. However, no legal liability is incurred by the enterprise for the payment of the corresponding dividends since 34/18 participation in equity normally takes the form of nonconvertible preferred stock. In many cases, the by-laws of the corporation which is to manage the undertaking stipulate that dividends in excess of the 12% be distributed in the same manner for common and preferred stock. Naturally, this is one of the factors which has a direct bearing on the degree of risk imputed to the project both by the entrepreneur who invests his own resources in it and by those who invest their 344/18 tax savings.

The price of capital invested in approved projects depends on the relative shares of own and borrowed capital on the one hand and 34/18 funds attracted to the undertaking on the other. It is useful to distinguish between the two capital markets which coexist in this case: that of private capital as it normally funcions in the

21 MINTER/SUDENE, *Incentivos Fiscais e Financeiros para o Nordeste*, p. 48. Traslated from the Portuguese original.

country, and the "captive" capital market created by the introduction of fiscal incentives for use in specified areas and sectors of activity. Given the special nature of the 34/18 market, the cost of capital in it may be considered lower, since it is subsidized. From this point of view, the substitution of 34/18 funds for own or borrowed capital is always advantageous. It is therefore up to the entrepreneur to utilize 34/18 funds to the maximum permitted by the point system adopted by SUDENE.

## 5.4 — The Choice of Technologies

Projects submitted to SUDENE are generally prepared by specialized firms well acquainted with the point system, the general characteristics of project evaluation procedures and the alternative financing schemes available. It can be taken for granted that entrepreneurs and industrial consultants will seek to maximize profits in formulating industrial projects.

But what is the nature of this maximization? And what are the variables that theoretically influence entrepreneurial decisions?

First of all, it should be noted that the data used in the present study are drawn from industrial projects already approved by SUDENE. These estimates reflect the economic expectations held by entrepreneurs rather than actual production experience. Moreover, the project data may contain certain intentional distortions in order to conform more closely to the criteria adopted by SUDENE.

However, these factors are unlikely to produce serious distortions in the variables we propose to analyze here. As already observed, the cost of capital depends on the composition of investment financing and the relative share of 34/18 funds. In turn, this share is determined by the number of points granted to the project by SUDENE. The cost of labor can be taken as given if it is assumed that an individual project does not significantly alter the local demand for labor. Alternatively, the minimum wage may be used to indicate labor cost although this is a cruder measure. Final product prices, as well as the cost of raw materials, intermediate inputs and other inputs, are based on prices levels prevailing at the time of project formulation. Although substantial variations may well occur before project implementation, there is no way to allow for these changes

in the present paper. Total investment, labor force and input requirements are naturally related to expected output levels. Whether or not these are achieved is not important. Profits in any production activity ultimately depend on the three groups of variables mentioned above: production techniques, factor costs and final goods prices. As the last two are determined by market forces, profit maximization will depend on two remaining considerations: the amount of resources obtained through 34/18 channels and the production methods utilized.

The participation of 34/18 funds in total financing depends on the priority category to which the project is assigned. This is determined by reference to the very general criteria of the point system. In fact, given quite descriptive data, such as the goods to be produced by the new plant, its location and the proportion of raw materials and secondary inputs of regional origin, it is possible to make a fairly accurate estimate of the priority category for the project. Thus, a rude-of-thumb estimate of the cost of capital can be obtained prior to the preparation of the project or even before the feasibility study is undertaken.

There remains the choice of production technique. We assume the existence of a production function common to the different plants in the same industry, that is, a function which describes the range of possible factor combinations at the projects level (with due attention to the properties defined by neoclassical theory). If, in addition, we assume final goods prices are given, it can then be inferred from the axiom of profit maximization that choice of technique will depend on factor prices. That is, firms which obtain their capital at a lower cost than other firms should adopt more capital-intensive techniques. This, in fact, is the fundamental hypothesis of the present analysis.

The econometric analysis which follows explores the possibility of changing relative factor costs in order to influence the choice of techniques. In principle, this is feasible, since the cost of capital, at least in the projects approved by SUDENE, depends on the criteria for granting financing. We also see to establish which branches of industry offer the greatest scope for the substitution of more labor-intensive techniques. We recognize that many elements other than relative costs doubtlessly influence the choice of techniques. The present paper is intended simply as a contribution to the analysis of this subject. It is hoped that the results reported below will be relevant to the formulation of regional growth strategy and broader analyses of the Northeastern "problem".

## 5.5 — Assumptions Adopted for the Production Functions

In the present study, a logical structure commonly used in cross-section analyses is assumed for the production functions derived from the new industrial projects approved by SUDENE.

Instead of industries, individual enterprises in the same industry will be used as the unit of analysis. Furthermore, since project data are utilized, each represents a point on an *ex-ante* production function. This, by definition, will always be the same for all enterprises since, in principle, each one has access to the same set of techniques. As the data we use theoretically map out the *ex-ante* technology (in our case, at the individual enterprise level) aggregation problems are avoided. [22] In addition, the use of data on individual firms allows as to draw more direct inferences concerning the effects of relative factor price changes. In essence, we are testing an hypothesis commonly postulated at the aggregate level, and thus dependent of the validity of aggregation theorems, in a context where these are of little methodological importance.

Therefore, if different firms have chosen different points of the same production function as the result of differences in the relative factor prices, we would expect new manufacturing units in the same industry to show the same behavior. On the other hand, if a given function is considered the geometric locus of the efficient points of production, the theoretical existence of an optimal production unit, representative of a set of such plants, can be postulated. That is, prior to the installation of an enterprise there is an *ex-ante* technology. It also follows that if new manufacturing units encounter different relative prices at the time of installation, they will operate at different points of he same producion function, according to the maximization rationale.

Although rather uncommon, the employment of microeconomic data appears to be perfectly valid. Indeed, as J. B. Edwards and G. H. Orcutt have shown (though in a different context), empirical estimates of the parameters of a function are more reliable when statistical operations are performed with less aggregated data. [23]

[22] It is interesting to note that even for aggregation studies the *ex-ante* technology does not present aggregation problems. As Fisher observes: "For a 'putty-clay' technology such as analyzed by Johansen, the aggregation problem essentially involves the *ex-post* technology". F. M. Fisher, "On the Existence of Aggregate Production Functions," *Econometrica* 37 (October 1969) : 554.

[23] J. B. Edwards and G. H. Orcutt, "Should Aggregation Prior to Estimation Be the Rule?" *The Review of Economics and Statistics* 51 (November 1969) : 409-420.

The main reason given for the nonutilization of microeconomic data by these authors is their scarcity. [24] Nadiri, among others, expressly suggests the use of microeconomic data for estimating production functions. [25] It should also be noted that "best practice" in the choice of factor proportions is more readily observed at the microeconomic level, whereas it is possible to infer only "average practice" from the aggregate data.

## 5.6 — The Data

The data used in this study are drawn from the new industrial projects approved by SUDENE during the period 1962-April 1970. [26] The relevant variables are: capital ($K$), defined as total investment in each project at constant 1969 prices, and labor ($L$), measured by the cost of the total labor employed.

Since these estimates may be altered as the result of errors in variables, let us first analyze this possibility. The existence of measurement errors is quite plausible in view of the financing mechanism adopted by SUDENE. In fact, it would be quite possible to reduce the cost of capital by substituting 34/18 resources for own or borrowed capital beyond the limits set by SUDENE — for instance, by overestimating total investment. Similarly, if a project has a high capital/labor ratio when initially formulated and so runs the risk of being awarded fewer points, there is an incentive to underestimate total investment. Subsequently, once the project is approved, the firm can request that the amount of total investment be revised by alleging that implementation costs have since risen. Thus, although we recognize the possibility of such bias, it is difficult to determine beforehand the direction it will take. Of course, the incidence of these illegal practices depends on the efficiency of SUDENE in analyzing projects and supervising their

[24] "However, a more important reason may be that suitable micro data are much more scarce than macro data, and that we are not skilled in collecting micro data and using it (sic) with micro models." *Ibid.*, p. 410.

[25] M. Ishaq Nadiri, "Some Aproaches to the Theory and Measurement of Total Factor Productivity: A Survey," *Journal of Economic Literature* 8 (December 1970): 1135-97.

[26] On the methodology adopted to obtain data for 34/18 industrial projects, see David E. Goodman and Roberto Cavalcanti de Albuquerque, *Incentivos à Industrialização e Desenvolvimento do Nordeste*, Relatório de Pesquisa, n.º 20 (Rio de Janeiro: IPEA/INPES, 1974), pp. 377-97. Also see fn. 16 above. It should be observed that, due to the lack of sufficient data for some of the projects, the number of new projects considered (426) is less that referred to in section 3.2 above.

subsequent implementation. [27] Available data on employment and wages may also present errors but, as in the case of capital, there is no way to determine their direction and significance.

## 5.7 — Definition of Variables

The variables are defined as follows:

$K$ = capital (total investment)
$L$ = total labor employed (number of jobs)
$w$ = average annual wages (including social security charges)
$Y$ = annual net value added (depreciation excluded)
$r$ = rate of return on capital, defined by the expression

$$r = \frac{Y - wL}{K}$$

$\pi$ = cost per unit of capital invested, represented by

$$\pi = \frac{a_1 (K - F_{rp}) + a_2 F_{rp}}{K}$$

where $F_{rp}$ is the own capital employed in financing total investment. [28]

[27] Another source of error in the variable "capital" may be the existence of different brokerage rates, both over time and for individual projects, for attracting 34/18 funds. It is known that these rates are generally included, up to the limit of 5%, in the total investment estimates prepared at the project level. However, actual rates, particularly in recent years, have usually exceeded this percentage and also vary substantially in a market which offers great scope for discriminating between projects entitled to the benefits of 34/18 resources. However, it would be difficult to consider all these possibilities in the present study.

[28] For approved new industrial projects the share of own resources in project financing averages 23% and that of 34/18 funds 43%. Hence, loans account for approximately 34% of the total financing (14% from BNB). Since these loans, particularly those granted by BNB, are frequently obtained at negative *real* interest rates, we are justified in considering them as an alternative form of capital subsidy.

Given the difficulty of estimating the costs of capital financing, we have chosen the dual classification "subsidized capital" ($K-F_{rp}$) and "nonsubsidized capital" ($F_{rp}$). The parameter $a_1$ is therefore an average, reflecting the approximate cost of combining funds from different sources. The variable $r$ is defined to include the remuneration of both "own capital" and "outside capital" considered as "quasi-rent" of the projects. Since the functional payment to capital exceed this "quasi-rent" by a wide margin, they can be taken as a measure of the cost of capital.

With respect to the parameters $a_1$, $a_2$, the values .03 and .15 were finally selected. Despite the apparent arbitrariness of this choice, it may be defended on the following grounds: (i) this pair yielded results very similar to those obtained when using the rate of return to capital, $r$, which implies the same rationale is used to equalize productivity and prices; (ii) the results for other alternative pairs are not far removed from those obtained for the constants of this analysis; and (iii) the figure .15 corresponds to the shadow price or opportunity cost of capital in the Northeast calculated in an independent study which utilizes the same 34/18 project data. [29]

## 5.8 — Estimation Method

The production function estimated for each industrial group shown in Table 2 [30] is the CES [31] developed by Arrow, Chenery, Minhas and Solow: [32]

$$Y = \gamma \left\{ \delta K^{-p} + (1 - \delta) L^{-p} \right\}^{-\mu/p} \qquad (3)$$

As is well known, this function fulfills the general requirements of neoclassical production functions. In effect, the efficiency parameter $\lambda$ denotes alterations in the product for given quantities of factors $K$ and $L$; the distribution parameter $\alpha$ determines the division of the product among the factors; $\mu$ measures returns to scale (being equal to one when return are constant) ; and $p$ is the measure of substitution among factors, following the formula

$$\sigma = 1/(1 + p)$$

This last parameter, by virtue of its importance to this study, merits additional clarification. It may be taken to be a measure of the degree of ease of substitution among the factors, or, alternatively, as an index of their similarity from the technological point of

[29] See Edmar L. Bacha, Aloísio B. Araújo, Milton da Mata and Rui Lyrio Modenesi, *Análise Governamental de Projetos de Investimentos no Brasil: Procedimentos e Recomendações*, Relatório de Pesquisa, n.º 1 (Rio de Janeiro: IPEA/INPES, 1971), pp. 93-96.

[30] The classification by branch of industry is that commonly used by the Fundação Instituto Brasileiro de Geografia e Estatística (FIBGE) for the presentation of national statistics. These industry groups are defined to include an adequate number of projects in each without aggregating dissimilar sectors.

[31] Function (3) is capable of representing any technology with a constant elasticity of substitution. It includes as special cases the Cobb-Douglas function, with unitary elasticity of substitution, as well as functions of the Leontief type, in which this value is equal to zero.

[32] K. J. Arrow, H. B. Chenery, B. S. Minhas and R. M. Solow, "Capital Labor Substitution and Economic Efficiency," *The Review of Economics and Statistics* 43 (August 1961) : 225-50.

view.[33] Furthermore, the supposition that the elasticity of factor substitution is greater *ex-ante* than *ex-post* appears plausible. This accords with casual observation, which usually casts doubt on the feasibility of substitution in the case of already installed production units, and emphasizes the various possible factor combinations available at the project level. Even where equipment can be used to produce the same product, there are likely to be differences in technical specifications, prices, etc.[34]

Various procedures for estimating function (3) can be used, though they usually involve simple combinations of basic equations derived from (3), such as

$$\text{Log } \frac{K}{L} = \sigma \log \left(\frac{\delta}{1-\delta}\right) + \sigma \log \frac{w}{r} \qquad (4)$$

and

$$Y = \gamma \left\{\hat{\delta} K^{\hat{\rho}} + (1-\hat{\delta}) L^{\hat{\rho}}\right\}^{\frac{-\mu}{\hat{\rho}}} \qquad (5)$$

Parameters $\sigma$ and $\delta$ are estimated using equation (4). The values obtained in (5) are then substituted to obtain the remaining parameters.

Estimating $\sigma$ with equation (4), where $r$ is the cost of capital, gives unbiased estimates of this parameter, even if the returns to scale are not constant but vary with output.[35] Estimating the remaining CES parameters by means of equation (8) depends on capital and labor not being correlated with the residual. Although in the majority of past studies this has not been plausible, this hypothesis here follows directly from the maximization principle since the entrepreuneur must first decide the level of factor utilization.[36] The estimates given below are derived from equations

33 See M. Brown, *On the Theory of Measurement of Technological Change* (Cambridge: The University Press, 1968), p. 17.

34 Consideration of the possible differences between the *ex-ante* and *ex-post* elasticity of substitution has led to the development of the so-called "putty clay" models, originally elaborated by L. Johansen in "Substitution versus Fixed Production Coefficients in the Theory of Economic Growth: A Synthesis," *Econometrica* 27 (April 1959): 157-76. Subsequent studies have been made by E. Phelps, "Substitution Fixed Proportions, Growth and Distribution," *International Economic Review* 1 (September 1963): 265-68, and R. Sollow, "Substitution and Fixed Proportions in the Theory of Capital," *Review of Economic Studies* 29 (June 1962): 207-218.

35 See David Soskice, "A Modification of the CES Production Function to Allow for Changing Return to Scale over the Function," *The Review of Economics and Statistics* 50 (November 1968): 446-48.

36 See Marc Nerlove, "Recent Empirical Studies of the CES and Related Production Functions," in *The Theory and Empirical Analysis of Production*, ed. Murray Brown, *Studies in Income and Wealth*, vol. 31 (New York: National Bureau of Economic Research, 1967), p. 107.

(4) and (5) by means of the least squares method. Alternatively, the parameter can be estimated by means of a nonlinear method, such as that proposed by Kmenta.[37] However, assuming measurement errors in the variables, this method produces particularly poor results, as ably demonstrated by Griliches and Ringstad.[38]

Other nonlinear estimation methods could be used. However, the arguments presented by Griliches and Ringstad are persuasive. Although they do not prove that direct nonlinear estimation presents the same problems observed in Kmenta's version, they argue that the criticism noted above also applies to estimates of curve parameters such as $p$ since, in the majority of case, the two methods yield similar results.[39]

## 5.9 — Results of the Analysis

One of the conditions required to obtain consistent estimates of the parameters with the least squares method is that the independent variables be measured without error. If this is not the case, it can be shown that such estimates are biased downward.

The results shown in Table 2 take this possibility into account: in part A of Table 2, the results obtained when assuming the absence of measurement error are given, while in parts B and C this premise is removed.

It is unnecessary here to undertaken a detailed discussion of econometric problems involved in the estimates presented.[40] Suffice it to say that, assuming errors in variables, the estimation of parameters by simples regression can follow either the classical method (which postulates a priori knowledge of the ratio of the error variances and, moreover, is linked to the hypothesis that the error terms are normally distributed) or the method of grouping variables. In view of the restrictiveness of the former, the second method was adopted following the Wald and Barlett versions.[41] In the first of these versions, it is demonstrated that where the lower

37 J. Kmenta, *On Estimation of the CES Production Functions,* Paper n.º 6410 (University of Wisconsin, Social Systems Research Institute, October 1964). Cited by Nerlove, p. 105.

38 Z. Griliches and V. Ringstad, "Error in the Variable Bias in Non-Linear Contexts," *Econometric* 38 (March 1970): 368-70.

39 *Ibid.*, p. 370.

40 On such problems, see J. Johnston, *Econometric Methods* (Tokyo: Kogakusha Co., 1963), pp. 148-75.

41 *Ibid.*

## Table 2

*Estimates of Elasticities of Substitution and of Capital Remuneration in New Industrial Projects Approved by SUDENE* [a]

| Industrial Group | | A | | | | B | | C | | No. of Projects |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\pi$ | $r$ | $R_1^2$ | $R_2^2$ | $\pi$ | $r$ | $\pi$ | $r$ | |
| Nonmetallic Minerals | $\sigma$ | ( .12034) .88848 | ( 090821) .88107 | .43771 | .57343 | 2.30085 | 1.59404 | 1.89567 | 1.48322 | 56 |
| | $\delta$ | 0.541 | .8881 | | | .9189 | .5495 | 8039 | .5575 | |
| Metallurgy | $\sigma$ | ( .11677) .71858 | ( 13071) .81135 | .31866 | .45579 | 1 75592 | 2 00907 | 1.90314 | 1.74988 | 43 |
| | $\delta$ | .707 | 9281 | | | 8667 | .5392 | .8165 | 5050 | |
| Machinery and Electrical and Transport Equipment | $\sigma$ | ( .18949) .60466 | ( .07860) 60641 | .34854 | 6109 | 1.54080 | 1.33851 | 1 53074 | 1.33510 | 55 |
| | $\delta$ | .829 | .9718 | | | .8705 | .6109 | .7849 | .5013 | |
| Wood and Furniture | $\sigma$ | ( 25992) .76692 | ( 21517) 69544 | .26617 | .30326 | 1 42824 | 2.08132 | 1.60189 | 2 21059 | 22 |
| | $\delta$ | 598 | .9545 | | | .8395 | .5305 | .7512 | .5283 | |
| Paper and Cardboard | $\sigma$ | ( .25369) .81449 | ( .26361) .61862 | .35180 | .22471 | 1 63756 | 2.81003 | 1.51014 | 2 55914 | 19 |
| | $\delta$ | .620 | .9780 | | | .8489 | .6678 | .7396 | 5833 | |
| Chemicals, Plastics and Pharmaceutical Products | $\sigma$ | ( 11529) .94529 | ( .07478) .64318 | .42965 | .47122 | 2.22511 | 1 34792 | 2 06078 | 1 41789 | 36 |
| | $\delta$ | .529 | .9822 | | | .9132 | .6855 | .8165 | .6047 | |
| Textiles and Clothing and Footwear | $\sigma$ | ( 11461) .79367 | ( .07376) .68226 | .35544 | .47380 | 2.36552 | 1.28643 | 2.44866 | 1 42268 | 66 |
| | $\delta$ | .628 | 9550 | | | .8984 | .6997 | .8236 | .6078 | |
| Food and Beverages | $\sigma$ | ( .11982) .93189 | ( .08230) 84029 | .36638 | .53118 | 2.81003 | 1.73889 | 2.46674 | 1.74994 | 57 |
| | $\delta$ | .775 | .901 | | | .9805 | .5413 | .8276 | .5215 | |
| Rubber, Leather Products, Tobacco and Miscellaneous | $\sigma$ | ( .13229) .86320 | ( .15059) 1.0111 | .47531 | .48959 | 1 92808 | 2.37350 | 1.75948 | 2 25288 | 72 |
| | $\delta$ | .501 | .8141 | | | .8996 | .6047 | .7899 | .5536 | |

Soure: IPEA/SUDENE research on industrialization of the Northeast (see fn 26).
All slope parameters are significant at 5"„. The numbers in brackets are the standard-erros of estimate of the coefficients. For further classification, see the text.

limit of the distribution of the difference in the averages of the groups of variables (in groups of two) exceeds zero, in absolute value, the parameter estimates obtained are consistent. In the second version, given equally spaced values of the independent variable, the sampling variance is minimized, for given error variances, if the observations are divided into three groups and only the first and third used, following a formula analogous to that of Wald. Even superficial analysis of the results immediately reveals great disagreement between the estimates obtained according to the different sets of hypotheses. Appreciably higher elasticities of substitution occur when the hypothesis of errors in variables is introduced. However, speculation as to which set of parameter estimates is more reliable is pointless. It is true that the presence of errors in the variables was noted as a real logical possibility but we have no means of evaluating the nature of these errors in empirical terms. Any judgment in this respect would necessarily be a priori. Nevertheless, onde conlusion emerges strongly from the results obtained, namely, *entrepreneurs react to changes in relative prices*. While it is not possible to determine the magnitude of this response with great precision, its direction can be established as well as its "pessimistic" and "optimistic" limits. The latter correspond to the values obtained on the hypothesis that measurement erros in the variables are absent (part A of Table 2) or present (parts B and C), respectively.

Given the concept of the elasticity of factor substitution — the percentage change in the $K/L$ ratio given a 1% change in relative prices — the estimates presented in Table 2 demonstrate that, in principle, it is possible to influence the choice of techniques by modifying relative prices. However, the results obtained fail to give a clear indication of the sectors most amenable and responsive to such intervention. Nevertheless, if we accept the validity of a criterion based on the estimation methods used, the problem can be resolved. The method of estimation which assumes errors in the variables produces cruder estimates than the least squares method. Consequently, it can be argued that estimates obtained by this latter method, though possibly biased, provide a more accurate indication of the relative magnitude of the elasticities of substitution. In this connection, we may note that the relative size of the elasticities of substitution obtained when assuming no measurement errors accords with expectations based on knowledge of the respective industry groupings and common sense. That is, high elasticities of substitution in "Food and Beverages" and low

elasticities in "Machinery and Electrical and Transport Equipement". Some additional evidence which also recommends this criterion is the fact that the Spearman correlation coefficient between the order of elasticities obtained for the parameters estimated assuming absence of measurement errors and the order of average $K/L$ ratios is equal to .518, significant at the 10% level. This indicates that the substitution of capital for labor is more intensive in those industries where the technological similarity between the production factors is greater.

With regard to the intensity of the reaction to factor price changes, if we admit the possibility of measurement errors in the variables, then the conclusion will almost certainly be different. Since parameters obtained by minimum least squares methods are biased downwards given the presence of errors in the variables, the intensity of this reaction will in turn be underestimated. Although it is impossible to establish the exact degree of underestimation, it is unlikely to be low in view of the substantial difference between the parameter estimates obtained according to the alternative hypotheses.

The values obtained by estimating the returns-to-scale parameter, $\mu$, calculated by introducing the values $\sigma$ and $\alpha$ (given in part A of Table 2) into equation (5), are included in Table 3. This procedure was not followed for pairs of other $\sigma$ and $\alpha$ since there is no way to judge which results are best and also because the intention was to obtain reliable estimates of the relative values of $\sigma$ and $\alpha$. In this case, the returns to scale may be considered to be practically identical for all industry groups, with the exception of "Textiles and Clothing" [42] and "Machinery and Electrical and Transport Equipment". In fact, it appears valid to accept the absolute values observed and assume that constant returns to scale prevail in nearly all groups of industries, except the last three mentioned above. Estimates of the parameter $\alpha$, which measures capital remuneration, show great variation. Still, if the values observed for the projects are considered as the best available approximations, the estimates of $\alpha$ is about .66. The implications of the 34/18 program for income distribution and the expansion of the consumer market in the light of this result are too obvious to require further comment.

[42] The returns to scale observed in this industry group probably reflect the presence of projects for medium-size clothing firms, which utilize labor intensively, and modern textile-producing units, which are relatively large in size and use technologically advanced production methods.

Table 3

*Estimates of Returns to Scale in Industrial Projects Approved by SUDENE* [a]

| Industrial Group | $\mu$ | $R^2$ | N.° of Projects |
|---|---|---|---|
| Nonmetallic Minerals | 1.1586 ( .0796) | .7390 | 56 |
| Machinery and Electrical and Transport Equipment | 2.4507 ( .1627) | .8162 | 55 |
| Wood and Furniture | 1.1586 ( .1529) | .7414 | 22 |
| Paper and Cardboard | 1.9987 ( .1491) | .9135 | 19 |
| Chemicals, Plastics and Pharmaceutical Products | .8311 ( .04016) | .9265 | 36 |
| Textiles and Clothing and Footwear [b] | 5.6375 ( .3095) | .8382 | 66 |
| Food and Beverages | .0357 ( .0785) | .7207 | 57 |
| Rubber, Leather Products, Tobacco and Miscellaneous | 1.0702 ( .0548) | 8444 | 57 |

Source: IPEA/SUDENE research (see fn. 26).

[a] All parameters significant at 5%.

[b] The excessively high values for $\mu$ in "Textiles and Clothing and Footwear" are mainly due to the high degree of technological dualism in this sector.

## 6 — SUGGESTIONS FOR A REVISED DEFINITION OF THE INDUSTRIALIZATION POLICY

Finally, we consider the implications of the present analysis for the redefinition of industrialization policy in the Northeast in the seventies. Even a restrictive interpretation of the results obtained suggests that entrepreneurial decisions on choice of techniques react to changes in the relative factor prices. Correspondingly, it

should be possible to modify the capital-intensive character of the industrial development process by raising the cost of capital and, simultaneously, lowering the private costs of labor. This could be achieved by reformulating the point system to eliminate the current discrimination against those industries having greater elasticity of substitution and therefore the potential to absorb labor.

The cost of capital could also be raised if the ceilings on the share of 34/18 funds in investment financing were lowered. This measure is possibly indispensable, insofar as the diversion of tax credit funds into competing programs has reduced the supply of financing available to Northeastern projects.

Reduction of the cost of labor to an enterprises could be achieved, for instance, by revising methods currently used to finance social security programs. These onerous charges are presently borne by the firm and their removal or reduction would be, in effect, a subsidy to labor absorption.

The agencies presently administering industrialization policy could also adopt project assessment criteria which incorporate the suggested modification in relative factor prices. This would tend to reduce capital intensity and accelerate industrial labor absorption, thereby modifying the functional distribution of income and the personal income distribution with favorable repercussions on the regional consumer market.

In any case, we fully recognize that relative factor prices are only one element which determines the capital/labor ratio.

Other forces undoubtedly influence entrepreneurial decision when selecting technology. Nevertheless, it appears both necessary and opportune to revise present industrial policy. Although the point system and the incentive mechanism have stimulated the recent process of industrial growth in the region, serious distortions have been introduced which could be corrected or attenuated. In fact, SUDENE, in official documents, has revealed its disenchantment with the efficacy of the industrialization program as a means of dealing with the problems it was intended to solve. Frequent reference is made to the acute and persistent urban underemployment and the low labor-absorption capacity demonstrated by projects financed with 34/18 resources. However, these facts seem to be accepted with a certain amount of resignation, often with the implication that GTDN and the first generation of planners of that agency were overly optimistic about the capacity of modern industry to absorb labor. Thus, "the level and nature of technological development, as well as the need for competitiveness in Northeastern industry, imply high capital intensity, reducing the possibility that industry will contribute significantly towards the

solution of the problem of underemployment and unemployment". [43]

From the very first, evaluations of the incentive policy for regional industrialization have expressly recognized the limited direct employment creation associated with projects financed with 34/18 funds. Similarly, the small labor share in the value added of new industrial enterprises has been noted as a factor inhibiting the growth of local markets. [44] It therefore appears probable that the timid attempts to modify industrialization policy resulted not from unawareness of the distortions introduced, but rather from reluctance to reduce the attractions offered to potential investors. Such a reduction might induce potential investors to opt for investment opportunities in other regions or sectors equally favored by the mechanism of fiscal and financial incentives to the detriment of the Northeast. This concern, certainly reasonable from the regional angle, may also have contributed to the permissive and indiscriminately receptive attitude that characterized project evaluation procedures in the sixties. This point reinforces the position that any modifications should embrace the entire system of fiscal incentives and not be restricted to a unilateral initiative by a single regional or sectoral agency. Nevertheless, once it is granted that an incentive mechanism more favorable to direct labor absorption in industry is feasible, then it is certainly the Northeast (where the problem of urban underemployment is particularly serious) which is likely to be most affected. This is no without irony since it was precisely recognition of the capital-intensive nature of regional industrialization and its consequent incapacity to absorb labor which has justified – at least in part – the recent efforts to channel considerable portions of 34/18 resources into other productive activities in the Northeast and other regions.

[43] MINTER/SUDENE, *IV Plano Diretor de Desenvolvimento Econômico e Social do Nordeste, 1969-1973* (Recife, 1968), p. 93. Translated from the Portuguese original.

[44] *Ibid.*, p. 59.

# MACROECONOMICS OF BRAZILIAN URBANIZATION *

*Hamilton C. Tolosa* **

## 1 — INTRODUCTION

As the economy reaches progressively higher income levels, more and more importance tends to be given to the objective of economic growth, while the external diseconomies arising from this process tend to be overlooked. The large metropolitan areas absorb infrastructure investments at an exponential rhythm, environmental pollution becomes more apparent, internal migrations accelerate, thus raising the indexes of urban underemployment and unemployment, and the distribution of income deteriorates. Frequently the solutions are deferred, or mere palliatives are sought for some of the more immediate effects of the accelerated urbanization. When society and government authorities become fully aware of the problem, the situation has already reached crisis dimensions. The corrective investments that then become necessary involve a high opportunity cost in terms of the very objective of economic growth.

Clearly, these problems represent only the negative side of the growth process. There also exist positive aspects. The large urban agglomerations offer conditions favorable to technological innovation and adaptation, to the emergence of new entrepreneurial activities and to cultural development. Some industries require that their plants be closer to the markets for products and qualified labor, and others need to be located near large financial centers. In short, the efficiency of an urban center

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is a relative concept depending on the manner in which each center adds costs and benefits to the urban system as a whole. As a corollary, any urban development policy must necessarily be defined at the national level. [1]

The empirical evidence of the last decades shows that the most noteworthy changes in the Brazilian urban system have occurred in the distribution of city sizes. Only recently have the first signs of spatial dispersion begun to appear.

The aim of the present study is to describe an explain the transformations through which the distribution of urban sizes in Brazil have been passing. This study is also intended to contribute to the definition of the national urban policy. It is therefore fitting to begin with a brief description of the factors that affect the size of a city.

In the urban size model, the city is considered an aggregate production unit, [2] as shown in Figure 1.

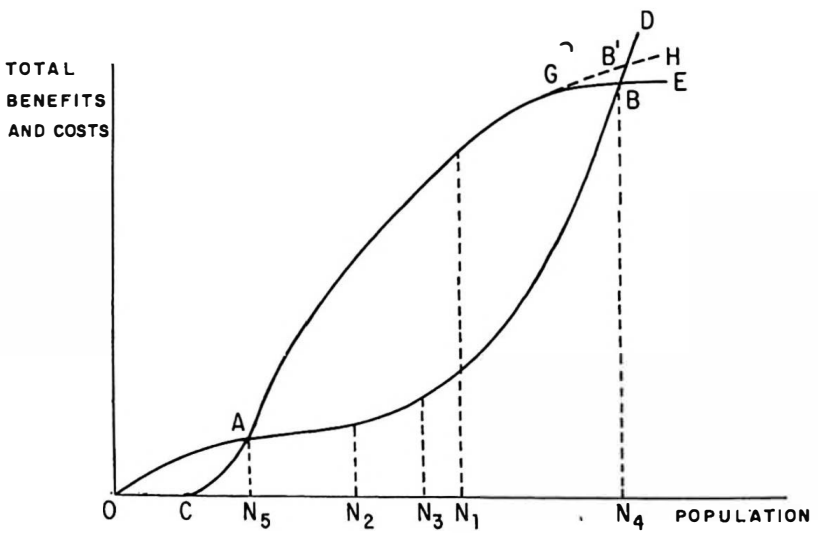


FIGURE 1 - Urban Size Model

1 See H. C. Tolosa, "Política Nacional de Desenvolvimento Urbano: Uma Visão Econômica," *Pesquisa e Planejamento Econômico* 2, n.º 1 (June 1972): 143-55.

2 The basic reference for the urban size model is W. Alonso, "The Economics of Urban Size," *Papers of the Regional Science Association* 26 (1971): 67-83. Also see H. W. Richardson, "Optimality in City Size, Systems of Cities and Urban Policy: A Sceptic's View," *Urban Studies* 9, n.º 1 (February 1972): 29-48.

On the horizontal axis is measured the urban population or city size. The curve OABD represents the long-run total costs, and CABE the long-run total benefits corresponding to each urban size. Point C defines the critical minimum size beyond which an agglomeration begins to perform the urban function. To the left of C, any groupment would incur only costs of agglomeration. The points to the left of A illustrate the types of problems found in maintaining small cities, which may enjoy the advantages of decreasing average costs, but are not yet able to generate a volume of benefits sufficient to cover total costs.

From the private point of view, the locational decisions of an individual or firm are based on the average costs incurred and the average benefits obtained in this city. For society, however, the costs and benefits brought to the city by a new inhabitant are measured in marginal terms. This difference between net social benefits and net private benefits can be expressed as: (MB − MC) − (AB − AC).

At the size level $N_1$, the marginal cost (MC) equals the marginal benefit (MB), maximizing the difference between total benefits and total costs. Assuming, for example, that the benefits of agglomeration can be measured exclusively in terms of urban product, and that the cost curve excludes the expenditures on labor, then $N_1$ defines the urban size that maximizes the local contribution to national product. Yet, as Alonso argues, from the point of view of the individual, the optimal size would be $N_3$, since at this level the difference between the average product and the average cost, i.e., the available income per capita, is maximized. [3]

The net social benefit becomes negative for any city larger than $N_1$. Still, for the individual, even the sizes between $N_1$ and $N_4$ are acceptable, though second-best since the average benefits (AB) surpass or equal the average costs (AC). Point B corresponds to a size limit beyond which the city becomes unfeasible in social as well as in private terms. However, as Hirschman suggests, the economic agents may overestimate the external economies generated by the large centers. [4] In this case, the benefit curve would be artificially extended along the broken line GH, displacing point B to B'. [5] It is quite possible that point B does not even exist, thereby giving rise to the megalopolis.

[3] Alonso, p. 71.

[4] A. O. Hirschman, *The Strategy of Economic Growth* (New Haven: Yale University Press, 1958), p. 185.

[5] One needs to distinguish between the expected benefits and those actually received. It is quite possible that the entrepreneur, having recognized that he committed an error in foresight, may try to reformulate his decision by

It is a matter of economic policy to decide which urban size is desirable from the social standpoint. If the goal is economic efficiency, the optimal size would be $N_1$, where the national product is maximized. In a policy emphasizing equity, the optimal city size might be different. In short, the notion of an optimal city size is ambiguous and depends on the objective established in the urban development policy. [6]

The urban size model is a static one. It is recognized that the cost and benefit curves vary over time and from city to city due to technological progress, changes in consumer and producer preferences and governmental action. Despite these limitations, however, the model furnishes a theoretical basis for studying the actual structure of urban sizes.

The sections that follow begin with a long-term retrospective study of the total urban sector and conclude with a disaggregate static analysis of city sizes. More precisely, the second section deals with the performance of the Brazilian urban sector in the last 50 years, giving stress to population, employment and generation of income. The third section concentrates on a comparative static analysis of these same variables in the sixties. It also includes an attempt to identify the sources of growth of the urban population during this last decade. The fourth section examines main characteristics of the Brazilian urban-industrial structure in 1969, such as productivity, wages, specialization and economies of scale. There is a discussion on the use of variables such as productivity, wage rate and family income as proxies for the average benefits in the urban size model. The fifth section is concerned with the important question of intra-urban income distribution and with the comparison of the demand structure by type of city. The sixt section introduces the second element of the model costs. A discussion on the use of per capita infrastructure expenditures as a proxy for cost is also presented. Finally, the seventh

returning to a smaller center. However, insofar as the factory is already installed, the move will involve high relocation costs, a fact which confers on decisions a certain degree of irreversibility. This inertia of the urban system may be largely responsible for the negative externalities observed in the large metropolitan areas — environmental pollution, congestion, psychological effects, etc. In the case of the individual, mobility is clearly much greater, giving rise to return migrations.

6 The literature on optimal size of cities has been exclusively concerned with inputs (costs), setting aside the question of benefits or else considering them as constant. Within this focus, the optimal size would be $N_2$, where the average cost is minimum. See Alonso, pp. 68-70.

section summarizes the conclusions of the study, giving emphasis to economic policy.

This study does not pretend to be exhaustive, nor its conclusions to be considered definitive. As previously mentioned, one of its main purposes is to contribute to the debate concerning the national urban development policy, a subject of great relevance in the present stage of the Brazilian economy.

## 2 — THE PERFORMANCE OF THE URBAN SECTOR: 1920-1970

A set of the most relevant indexes of the performance of the Brazilian urban sector is presented in Table 1, providing the statistical support for the long-run analysis developed in this section. [7]

If urban population is taken as the representative index, it can be said that in Brazil the most intense urbanization occurred between 1940 and 1960. However, this growth was not uniformly distributed throughout the urban sector. For example, in the fifties the cities having over 20 thousand inhabitants experienced an outstanding expansion. And, more recently, those in the size class 100 to 250 thousand persons have been prominent. It is important to emphasize that the prominence of the intermediate cities coincided with the industrial boom promoted via the import substitution process. More precisely, it occurred in the fifties, when the growth of the real industrial product reached an average rate of 8.9% per year. During the sixties appeared the first signs of dispersion in the urban system, a process that should accelerate in the future through the consolidation of the intermediate cities located far from the metropolitan areas of today. At the same time, the degree of primacy of the most important metropolitan areas, Rio and São Paulo, progressively

[7] The basic statistical sources are the population censuses and the national accounts. Though the raw data on population have been adjusted for year-to-year changes in census classifications, the statistics should still be interpreted with due caution. Likewise, caution should be taken in the use of the national accounts, for there are some pitfalls in the figures for product, especially with respect to the tertiary sector. The reader will find an excellent comparative study of the Brazilian censuses in A. V. Villela and W. Suzigan, *Política do Governo e Crescimento da Economia Brasileira, 1889-1945*, Série Monográfica, n.º 10 (Rio de Janeiro: IPEA/INPES, 1973), Appendix B. Concerning the tertiary sector, the most complete source is W. J. Manso de Almeida and M. C. Silva, *Dinâmica do Setor Serviços no Brasil*, Relatório de Pesquisa, n.º 18 (Rio de Janeiro: IPEA/INPES, 1973).

## Table 1

### *Indexes of the Performance of the Urban Sector in Brazil, 1920-1970*

| Index | Year | | | | | | | Annual Growth Rate (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1920 | 1940 | 1950 | 1960 | 1964 | 1967 | 1970 | 1920-1940 | 1940-1950 | 1950-1960 | 1960-1970 | 1960-1964 | 1964-1967 | 1967-1970 |
| | (Cr$ Million, at 1949 Prices) | | | | | | | | | | | | | |
| Gross Domestic Product | 68 1 | 140 5 | 244 8 | 472 9 | 573 8 | 649 2 | 847.2 | 3 7 | 5 7 | 6 8 | 6 0 | 4 9 | 4 2 | 9 J |
| Urban Income | 36 9 | 82 4 | 156 2 | 325 4 | 399 9 | 447 8 | 599 1 | 4 1 | 6 6 | 7 6 | 6 3 | 5 3 | 3 8 | 10 2 |
| Industrial Product | 9 3 | 23 7 | 50 5 | 118 7 | 149 1 | 163 4 | 232 3 | 4 8 | 7 9 | 8 9 | 6 9 | 5 8 | 3 1 | 12 4 |
| Product of the Tertiary Sector | 27 6 | 58 7 | 105 7 | 206 7 | 250 8 | 284 4 | 366 8 | 3 8 | 6 0 | 6 9 | 5 9 | 4 9 | 4.3 | 8 8 |
| | (% Ratio) | | | | | | | | | | | | | |
| Urban Income GDP | 54 2 | 58 6 | 63 8 | 68 8 | 69 7 | 69 0 | 70 7 | | | | | | | |
| Industrial Product/Urban Income | 25 2 | 28 7 | 32 3 | 36 5 | 37 3 | 36 5 | 38 7 | | | | | | | |
| Tertiary Product/Urban Income | 74 8 | 71 2 | 67 7 | 63 5 | 62 7 | 63 5 | 61 3 | | | | | | | |
| | (Cr$, at 1949 Prices) | | | | | | | | | | | | | |
| GDP per Capita | 2 2 | 3 4 | 4.7 | 6 8 | -- | — | 9.1 | 2 2 | 2 1 | 3 8 | 3 0 | | | |
| Urban Income per Capita | — | 7 5 | 8 3 | 10 2 | — | — | 11 3 | — | 3 2 | 2 1 | 1 0 | | | |
| Industrial Product per Worker | 7 3 | 16 7 | 20 8 | 40 1 | — | — | 44 1 | 4 2 | 3 7 | 6 8 | 1 0 | | | |
| Tertiary Product per Worker | 18 2 | 16 2 | 23 8 | 27 5 | — | — | 33.5 | 6 | 4 1 | 1 5 | 2 0 | | | |
| | (1 000 Inhabitants) | | | | | | | | | | | | | |
| Urban Population | n a | | 18 783 | 31 956 | — | — | 52 905 | — | 5 6 | 5.5 | 5.2 | | | |
| Urban Population 10 Years and over | n a | n a | 14 200 | 23 546 | — | — | 38 335 | — | — | 5 1 | 5 0 | | | |
| Labor force in Urban Sector | 2 773 | 5 034 | 6 863 | 10 488 | — | — | 16 220 | 3 0 | 3 1 | 4 3 | 4 4 | | | |
| Labor Force in Industry | 1 264 | 1 414 | 2 427 | 2 963 | — | — | 5 264 | 6 | 5 5 | 2 0 | 5 9 | | | |
| Labor Force in Tertiary Sector | 1 509 | 3 620 | 4 436 | 7 525 | — | — | 10 956 | 4 5 | 2 1 | 5 4 | 3 8 | | | |
| | (%) | | | | | | | | | | | | | |
| Share of Urban Population in Total Population | — | 26 4 | 36 2 | 45 1 | — | — | 55 9 | | | | | | | |
| Urban Population 10 Years and over/Total Urban Population | — | — | 75 6 | 73 7 | — | — | 72 4 | | | | | | | |
| Share of Urban Population in Total Population 10 Years and over | — | — | 38 8 | 48 3 | — | — | 58 1 | | | | | | | |
| Rate of Population Activity in Urban Sector | — | — | 48 3 | 44 6 | — | — | 42 3 | | | | | | | |
| Rate of Population Activity in Industry | — | — | 17 1 | 12 6 | — | — | 13 7 | | | | | | | |
| Rate of Population Activity in Services | — | — | 31 7 | 32 0 | — | — | 28 6 | | | | | | | |
| Share of Industry in Total Urban Labor Force | 45 6 | 28 1 | 35 4 | 28 3 | — | — | 32 5 | | | | | | | |
| Share of Services in Total Urban Labor Force | 54 4 | 71 9 | 64 6 | 71 7 | — | — | 67 5 | | | | | | | |
| | (1 000 Inhabitants) | | | | | | | | | | | | | |
| Population in Cities of over 20 000 Inhabitants | 4 552 | 6 209 | 10 335 | 21 073 | — | — | 34 207 | 1 6 | 5 2 | 7 3 | 5 0 | | | |
| Population of Greater Rio and Greater São Paulo | 1 370 | 3 198 | 5 141 | 7 559 | — | — | 12 389 | 4 3 | 5 0 | 4 8 | 5 0 | | | |
| | (% Ratio) | | | | | | | | | | | | | |
| Population in Cities of over 20 000 Inhabitants/Total Urban Population | — | 57 0 | 55 0 | 65 9 | — | — | 64 7 | | | | | | | |
| Population of Greater Rio and Greater São Paulo/Total Urban Population | — | 29 3 | 27 4 | 23 7 | — | — | 23 4 | | | | | | | |

Sources. For 1920 and 1940, the income and GDP estimates are based on the GDP and real product of industry and commerce indexes calculated by A. Fishlow in "Origens e Consequências da Substituição de Importações no Brasil," *Estudos Econômicos* 2, n.º 6 (1972): Appendix I for 1950 to 1970, the real product index published in the *Contas Nacionais* was used. For 1970, the service sector index is represented by the index for commerce due to the unavailability of data. Since the urban income and sectoral products are net of depreciation and at factor cost, the urban income/GDP ratio is slightly overestimated. The population data for 1920 were gathered from A. V. Villela and W. Suzigan *Política do Governo e Crescimento da Economia Brasileira, 1889-1945*. Série Monográfica, n.º 10 (Rio de Janeiro: IPEA/INPES, 1973), Appendix B. The statistics on employment and rate of population activity were taken from W. J. Manso de Almeida and M. C. Silva *Dinâmica do Setor Serviços no Brasil*. Relatório de Pesquisa, n.º 18 (Rio de Janeiro: IPEA/INPES, 1973), Table VI-2, and correspond to the original census figures corrected to permit greater comparability. The rates of population activity by sector are defined by the ouotr labor force urban population, considering the contingent 10 years of age and over. The remaining population data are census figures obtained from the Fundação Instituto Brasileiro de Geografia e Estatística — FIBGE.

decreased from 29.3% in 1940 to 23.7% in 1960, and stabilized during the last decade.

As to income generation, the urban sector has even greater importance. Its share in GDP evolved from little more than 54% in 1920 to nearly 71% in 1970. With the exception of short periods of recession, the growth rates of urban income have systematically remained above the overall GDP growth rates.

The dynamism of the urban sector in Brazil is in large part due to the expansion of industry. Yet, besides being a dynamic sector, industry is also especially sensitive to cyclical fluctuations. In order to examine the medium-term effects of these fluctuations on urban income, the decade of the sixties was divided into three subperiods. The first, extending from 1960 to 1964, was characterized by high rates of inflation, difficulties with the balance of payments and political instability. In the next period, covering the years 1964 to 1967, anti-inflationary measures had the immediate effect of reducing the growth rates of the Brazilian economy, eliminating marginal firms and creating idle capacity in industry. The third, from 1967 to 1970, was a period of recovery, characterized by the absorption of the existing idle capacity. Examination of the growth rates shows that fluctuations in industrial product are always greater than those in urban income, which means that the tertiary sector lessens the effects of the industrial fluctuations on total urban income. It is generally assumed that tertiary income growth is induced by industry. In Brazil, however, the service sector seems to have a dynamism of its own which enables it to counterbalance the effects of the other sectors.

The share of industry in total urban income shows a rising trend over the period 1940-1970. Disregarding possible errors in income estimates, especially concerning the tertiary sector, this fact not only reflects the leadership of industry in the urban development process, but also shows that modifications in the urban system are determined by the more industrialized intermediate and large cities, which act as macroregional or national market poles. [8]

On the other hand, underemployment and unemployment are increasingly becoming typically urban problems. With

[8] In this case there would not be much sense in speaking of a system of central places which are tertiary centers by definition. On this subject, see H. C. Tolosa, "Pólos de Crescimento: Teoria e Política Econômica," in *Planejamento Regional: Métodos e Aplicação ao Caso Brasileiro*, ed. P. R. Haddad, Série Monográfica, n.º 8 (Rio de Janeiro: IPEA/INPES, 1972) pp. 189-244.

the expansion of the transportation and communications systems and the consequent increase in the mobility of labor, cities are subject to the constant pressure of inmigration. A large part of these migrants compose the contingent of the urban unemployed or underemployed in the service sector, aggravating sectoral dualisms and giving rise to the so-called "rings of poverty" found in the peripheries of the metropolitan areas. In Brazil, the difference between average labor productivity in industry and in services (given by the product/employed worker ratio) has increased since the mid-fifties. In this same period the employment growth rate in industry reached its lowest level.

## 3 — THE DISTRIBUTION OF URBAN SIZES IN THE SIXTIES

Before analyzing the changes in the Brazilian urban structure during the last decade, it is fitting to discuss the criteria adopted for establishing the city-size classes. The size measure used is urban population. And for "urban center" is adopted the legal definition of a city as the seat of a *município*. Discussion is thus avoided as to what should be termed "city", that is, what the required minimum size is for an agglomeration to exercise typically urban functions. [9]

Urban population is an imperfect index for urban size; however, the available statistics do not permit a more adequate measure. As to the definition of "urban center", the analysis will not be greatly biased in this respect, since the main interest is in the intermediate and larger centers.

The truly important question concerns the class limits, for in this type of problem the results tend to be highly sensitive to different aggregation criteria. Furthermore, in the case of Brazil, a thorough study allowing for the identification of groups of similar urban centers is not yet available. Under these circumstances, the class limits were established according to an urban development approach, making use of the few existing studies. [10]

[9] This is basically a question of academic interest having little relevance to economic policy. In addition, the minimum size would not be constant, but should vary according to time and region.

[10] Among these stands out the recent study by the Fundação Instituto Brasileiro de Geografia e Estatística — FIBGE on polarized regions: *Divisão do Brasil em Regiões Funcionais Urbanas* (Rio de Janeiro, 1972). It should be noted, however, that while FIBGE is concerned with the spatial distribution of the urban centers (and their functions), the present article focuses on their distribution by size.

The metropolitan areas occupy a prominent position in the definition of a national urban development policy. On the other hand, it is known that these areas do not form a homogeneous set. With these ideas in mind, the metropolitan areas of Brazil were distributed in two classes: large metropolitan areas, or those with a population of over 2 million inhabitants, thus including Rio and São Paulo, the two largest urban agglomerations in the country; and secondary metropolitan areas, or those with a population of between 500 thousand and 2 million inhabitants. These latter are Belo Horizonte, Recife, Salvador, Porto Alegre, Belém and Fortaleza.

The follows the class of large cities, with a population of between 250 and 500 thousand inhabitants. In 1970, this class included Curitiba, Goiânia, Santos, Campinas, Manaus, Brasília and Natal.

The urban centers situated between the limits of 50 and 250 thousand inhabitants are denominated intermediate cities. The importance of these centers in urban development has attracted the attention of various authors, who have suggested that they be used as the prime instrument in a growth pole and territorial settlement policy. [11]

For the purpose of analysis, the intermediate cities were divided into two classes: intermediate class A, or those with a population of over 100 thousand inhabitants; and intermediate class B, or those with a population below this limit. A recent study indicates that there is evidence of economies of scale in tax collection and other government activities for Brazilian cities having more than 100 thousand inhabitants. [12] The cut at this population level is therefore justified.

The last size class is comprised of the small cities, or all those having a population of less than 50 thousand inhabitants.

Defining the class limits as above clearly involves a certain degree of arbitrariness. On the other hand, one of the principal byproducts of this study is to verify to what extent the classes selected accurately reflect the distribution of urban sizes in Brazil.

Another difficulty concerns the definition of the metropolitan areas, that is, the identification of the *municípios* that constitute these areas. The criteria differ from study to study, and the

[11] See, for example, N. M. Hansen, *Intermediate-Size Cities as Growth Centers* (New York: Praeger Publishers, 1971), and J. A. Kuehn and L. D. Bender, "An Empirical Identification of Growth Centers," *Land Economics* 45 (November 1969) : 435-43.

[12] Alofsio B. Araujo, M. H. Taques Horta and C. M. Considera, *Transferências de Impostos aos Estados e Municípios,* Relatório de Pesquisa, n.º 16 (Rio de Janeiro: IPEA/INPES, 1973).

question becomes even more complex when the intention is to compare the same metropolitan area at different points in time. For example, some centers which were an integral part of Greater São Paulo in 1970 were not so 10 years previous.

In Brazil, research identifying the *municípios* comprising the metropolitan areas at different moments is almost inexistent. For the present work, a study published by the Brazilian institute of geography was taken as the basis for identifying the metropolitan areas. The data was adjusted to include in these areas only *municípios* having a *minimum* of 30 thousand inhabitants in 1960 and 50 thousand inhabitants in 1970.[13]

The structural changes which occurred in Brazil during the last decade are illustrated in Table 2, which shows the composition of the urban system in 1960 and 1970.

Since urbanization is typically a long-term phenomenon, it is natural that the changes in distribution that occur over a decade should be relatively slight. In Table 2, one observes that among these changes the most notable is undoubtedly the increasing participation of the intermediate class A centers, to the detriment of the small cities. It should also be mentioned that although Greater Rio and Greater São Paulo nearly doubled in size over the period, their participation in the urban population remained stable at about 24%. As to the other classes, it is only worth noting the similarity in the behavior of the small and the intermediate class B centers, both with growth rates below the national average. These first conclusions indicate the advisability of treating these latter as a single class.

Generally speaking, the urban population differential for a period can be broken down into three principal sources of growth. The first considers the population growth resulting from the appearance of new centers in the system. The second refers to the population growth owing to the larger average size of the centers within each class. Finally, the third represents the growth determined by the recomposition of the centers among the

[13] See M. V. Galvão *et al.*, "Áreas de Pesquisa para Determinação de Áreas Methopolitanas," *Revista Brasileira de Geografia* 31, n.º 4 (1969).

In addition to facilitating the calculations and the comparison between the two periods, the adjustment made has the further advantage of including in the metropolitan areas only the most important cities, eliminating the smaller centers that are more subject to controversy. Still, it is necessary when interpreting the results to keep in mind that this criterion favors the large metropolitan areas in whose peripheries are located various cities above the fixed limits. On the other hand, the population of the large metropolitan areas is underestimated, as these are generally formed by centers below these limits.

Table 2

*Urban Population and Number of Urban Centers, Brazil, 1960 and 1970*

| Urban Size Class (1 000 Inhabitants) | Urban Population | | | Number of Urban Centers | | Growth Sources of Urban Population (%) | | |
|---|---|---|---|---|---|---|---|---|
| | 1 000 Inhabitants | | Annual Rate of Growth | 1960 | 1970 | New Centers | Average Size | Recomposition |
| | 1960 | 1970 | | | | | | |
| Less than 50 | 16 149 (50.6) | 24 456 (46.2) | 4.2 | 2 680 | 3 835 | 84.1 | 15.9 | |
| 50 — 100 | 2 174 (6.8) | 3 536 (6.7) | 5.0 | 37 | 49 | 51.6 | 48.4 | — |
| 100 — 250 | 1 835 (5.7) | 4 613 (8.7) | 9 7 | 14 | 32 | 84.9 | 15.1 | — |
| 250 — 500 | 1 322 (4.1) | 2 367 (4.5) | 6.0 | 4 | 7 | 94.8 | 5.2 | — |
| 500 — 2 000 | 2 917 (9.1) | 5 544 (10.5) | 6.6 | 4 | 6 | 55.5 | 44.5 | — |
| 2 000 and over | 7 559 (23.7) | 12 389 (23.4) | 5.1 | 2 | 2 | .0 | 100.0 | — |
| Total | 31 956 (100.0) | 52 905 (100.0) | 5.2 | 2 741 | 3 931 | 77.3 | 59.7 | - 37.0 |

Sources: IBGE, *Censo Demográfico*, 1960; and FIBGE, *Sinopse Preliminar do Censo Demográfico de 1970*, 1971.
Note: The numbers between parentheses indicate the share of each class in the respective total.

size classes, that is, by the variations in the number of centers in each class.[14] Obviously, within the same class the recomposition effect disappears, only the other two effects remaining.

In Table 2, the three right-hand columns show the breakdown by sources of growth. It should be observed that, of the total urban population increase in the period, approximately 77% was due to the new centers effect. This means that, if the distribution of the centers among the classes and the average size of these centers had remained unchanged during the period, the urban population growth due solely to new centers would have been equal to 77% of the population differential observed for the decade. Also, assuming the number of centers as given, nearly 60% of the differential would be due to the average size effect. Both effects are positive and thus act in the direction of increasing the urban population. In contrast, the sign of the recomposition effect is negative. This reflects the relative loss of the small cities, with a large share in total urban population, principally in favor of the intermediate class B centers, with a small share in the total. It also means that, if the composition of the classes had remained constant during the decade, the population growth would have been 37% greater than it was; in other words, the recomposition effect contributed negatively to the total population growth. If this trend continues in the future, the recomposition effect, by stimulating the growth of the intermediate cities, should counterbalance the positive result of the other effects, thereby preventing the growth rate of the total urban population from reaching higher levels.[15] Consequently, an economic policy seeking to emphasize the role of the intermediate centers would contribute not only to the objective of advancing territorial settlement, but also to reducing the potential rate of growth.

[14] If $P_t$ = the total urban population in the year $t$, $N_t$ = the total number of centers in the urban system, $E_{it}$ = the average size of the centers in class $i$ in the year $t$, and $N_{it}$ = the number of centers in class $i$, then

$$P_t = \sum_{i=1}^{6} N_{it} E_{it}, \text{ and defining } a_{it} = N_{it}/N_t \text{ gives}$$

$P_t = \sum_{i=1}^{6} a_{it} N_t E_{it}$. The right-hand side of the expression shows the three elements used for the breakdown of the growth sources.

[15] Considering only the "new centers" and "average size" effects, the Brazilian urban population would have reached 60 750 thousand in 1970, implying a geometric rate of increase of 6.6% per annum over the decade.

Taking each class individually, one observes that the new centers and recomposition effects were systematically more important than the average size effect for all classes, with the exception of the large metropolitan areas.[10] In the specific cases of the intermediate class A centers and the large cities, the dominance of the new centers effect is even more outstanding. Although the same phenomenon affected the small cities, the incorporation of new centers was not sufficient to keep the growth rate of the class from falling below the national average.

In conclusion, supposing that the trend is maintained, the prominence of the intermediate centers, allied to the constant share of Rio and São Paulo observed over the decade, indicates that the distribution of urban sizes in Brazil is evolving from a primate to a rank-size or lognormal form. On the other hand, the dominance of the new centers effect indicates that the spatial distribution of the cities is also moving toward a more balanced form, that is, with a greater degree of dispersion and territorial settlement. To what point these trends are the results of deliberate government policy is difficult to answer in view of the limited empirical evidence. However, the behavior of the system favors two objectives of the Brazilian government: the reduction of regional disparities and territorial settlement. Given these conditions, the basic concern of a national urban development policy should be to define the instruments for accelerating the process described above. One alternative might be to take advantage of the dynamism of the intermediate and large cities by concentrating investments in these centers. Even when distant from the large metropolitan areas, such cities offer the conditions, in terms of size and economic structure, necessary to sustain rapid growth.

Studies on urbanization are often limited to analysis of the urban population and its characteristics. However, this approach considers only one aspect of the problem, disregarding other important factors such as consumer preferences, locational decisions of producers and governmental action. As mentioned previously, the relationship between urbanization and industrialization

[10] It is important to emphasize that the "new centers" effect has one meaning for the overall urban population, and another for the classes taken individually. With reference to the overall population, the term "new centers" indicates the appearance of centers that did not exist in the base year. In the case of the individual class, this effect mainly reflects the net migration into or out of new or already existing centers. In practice, however, the appearance of new centers is almost exclusively limited to the class of small cities. For all others, this effect represents changes of class of centers that already existed in the base year.

deserves special attention. This is so due to the importance that locational decisions of producers have in conditioning the changes in the urban system, especially in the present stage of Brazilian development.

Table 3 was therefore constructed in order to show the urban size structures of industrial employment and product. The latter aggregate is here represented by the "value of industrial transformation" (VIT), which is commonly used in Brazil as a close proxy for the industrial value added. [17] To facilitate comparison, the structure of the urban population is repeated in this table.

Table 3

*Industrial Employment, VIT and Urban Population by Urban Size Class, 1960 and 1969*

(%)

| Urban Size Class (1 000 Inhabitants) | Employment | | VIT | | Urban Population | |
|---|---|---|---|---|---|---|
| | 1960 | 1969 | 1960 | 1969 | 1960 | 1969 |
| Less than 50 | 39.1 | 27.4 | 29.1 | 23.6 | 50.6 | 46.2 |
| 50 — 100 | 4.7 | 6.5 | 8.1 | 5.0 | 6.8 | 6.7 |
| 100 — 250 | 3.7 | 9.0 | 4.6 | 7.5 | 5.7 | 8.7 |
| 250 — 500 | 2.2 | 2.0 | 1.7 | 2.1 | 4.1 | 4.5 |
| 500 — 2 000 | 7.0 | 8.9 | 5.9 | 7.2 | 9.1 | 10.5 |
| 2 000 and over | 43.3 | 46.2 | 50.6 | 54.6 | 23.7 | 23.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Sources: FIBGE, *Produção Industrial*, 1969; *idem*, *Sinopse Preliminar do Censo Demográfico de 1970*, 1971; IBGE, *Censo Demográfico*, 1960; and *idem*, *Censo Industrial*, 1960.

It is desirable to make some observations beforehand on the statistics here used. First, since the data on employment and VIT refer only to the manufacturing industries, they include neither mining nor construction, which is an important absorber of labor. Second, the composition for 1960 was calculated from census data, while that for 1969 is based on annual surveys. For each industrial branch, these surveys take the firms into account, in decreasing order of the value of their sales, until reaching the

[17] The value of industrial transformation (VIT) is an imperfect substitute for the industrial value added, since it covers some expenses not included in the definition of product, such as taxes and advertising.

mark of 90% of the overall sales in each branch. Such a procedure normally discriminates against the small firms. Consequently, the grouping of this data by urban centers tends to lead to an underestimation of the small cities, since in Brazil it is precisely in these smaller centers that the small firms have the greatest importance. Also, despite the fact that the sample covers 90% or more of the overall sales value, employment and VIT are not necessarily equally representative. However, the VIT should be highly representative, especially for the large cities and the metropolitan areas.

Table 3 shows that in Brazil the distributions of employment and VIT differ fundamentally from the distribution of urban population. For example, whereas 50% of the urban population was located in the small centers during the sixties, precisely the opposite was true of the other two distributions, since approximately half of the employment and VIT was concentrated in Greater Rio and Greater São Paulo. Even considering the underestimation of the small cities, this concentration should still be quite appreciable. In short, in terms of spatial distribution, employment and VIT appear to be much more concentrated than urban population; and, more important yet, this concentration increased during the sixties. From the point of view of a policy aiming to stimulate the absorption of labor, and considering the dynamic role of the manufacturing industries, it is significant that nearly half of the employment opportunities in these industries are located in the two primate cities. As will be seen later on, these facts merely reflect the interplay of factors of supply (such as differentials of productivity, degree of specialization and agglomeration economies) and demand (level and distribution of income, structure of current expenditures, etc.).

The growing importance of the intermediate class A centers as absorbers of labor is confirmed in Table 3. From 1960 to 1969 these centers increased their share in total industrial employment by more than 5%, the greatest gain among all the classes. This increase was achieved to the detriment of the small cities, which showed a negative difference of nearly 12%. Thus, the intermediate class A centers came to occupy third position in total employment, practically matching the secondary metropolitan areas. The performance of these centers in VIT formation should also be stressed. Their share in total VIT increased by nearly 3%, thereby placing them immediately after the primate cities.

## 4 — PRODUCTIVITY, SPECIALIZATION AND ECONOMIES OF SCALE

This section attempts to distinguish the industrial characteristics of the centers within each size class. To this end, attention was focused on the most recent year for which information was available, that is, 1969. Also in accordance with the urban size model, it is assumed that the product per capita is an increasing function of urban size, explained by variables such as agglomeration economies, degree of specialization, communication facilities, etc. In short, it is assumed that the per capital product measures the degree of efficiency of an urban center, and that the larger cities are more efficient than the smaller ones. If economic efficiency is the policy objective, this reasoning implies a concentration of activities in the large centers, possibly in the primate cities. Clearly, this is only a partial view, since it omits cost considerations.

Table 4 gives some of the principal characteristics of the Brazilian urban-industrial system in 1969. In the absence of appropriate indexes of the economic efficiency of the cities, such as per capita local product, an index of average productivity of labor was used. The limitations of this index are obvious. In the first place, as it refers only to industry, it can not be generalized for all of the cities in spite of the dynamic role of this sector. For example, the urban centers specialized in tertiary activities are inaccurately represented. Another limitation concerns the measure of productivity, not only because it refers to only one production factor (labor), but also because the concept of marginal productivity is more relevant than that of average productivity in characterizing the efficiency of an urban center.[18] The data in Table 4 should therefore be interpreted with due care if the intention is to describe cities in general. Nevertheless, these data are good indexes of the level of industrial activity for each urban size class.

From the first column in Table 4, one can ascertain that, in spite of some explainable irregularities, average productivity increases with urban size.[19] The low value for the secondary

18 It has already been seen that, if the objective is to reach the highest degree of economic efficiency in the urban system, the optimal size of each city is defined by the point at which the marginal cost equals the marginal product. At this point, the contribution of the city to the national income is maximized. See Alonso, pp. 70-71.

19 In section 4.2 of their work *Desenvolvimento Regional e Urbano*, Relatório de Pesquisa, n.º 15 (Rio de Janeiro: IPEA/INPES, 1973), S. Boisier, M. O. Smolka and A. A. de Barros attempt to adjust exponential functions to the

## Table 4

### *Characteristics of Industrialization by Urban Size Class*
### (Manufacturing Industries, 1969)

| Urban Size Class (1 000 Inhabitants) | Average Annual Productivity (Cr$ 1 000) | Average Annual Wage (Cr$ 1 000) | Surplus (Cr$ 1 000) | Degree of Industrialization | Degree of Specialization (IE) | Degree of Specialization (VIT) | Specialization in Traditional Industries | Percentage Share of Large Firms in Total Industrial Employment | Percentage Share of Large Firms in VIT |
|---|---|---|---|---|---|---|---|---|---|
| 50 - 100 | 13.55 | 2.87 | 10.68 | 3.7 | .61 | .61 | .61 | .32 | .34 |
| | ( .43) | (.29) | | | | | | | |
| 100 - 250 | 13.43 | 3.15 | 10.28 | 3.9 | .58 | .58 | .51 | .41 | .46 |
| | ( .37) | (.38) | | | | | | | |
| 250 - 500 | 17.82 | 3.60 | 14.22 | 1.7 | .47 | .51 | .51 | .31 | .31 |
| | ( .44) | (.28) | | | | | | | |
| 500 - 2 000 | 12.83 | 3.32 | 9.51 | 3.2 | .51 | .51 | .52 | .29 | .34 |
| | ( .21) | ( .19) | | | | | | | |
| 2 000 and over | 20.63 | 5.12 | 15.51 | 7.6 | .46 | .42 | .33 | .42 | .50 |
| | ( .01) | ( 05) | | | | | | | |
| National Average | 17.55 | 4.43 | 13.12 | 3.8 | .46 | .45 | .43 | .37 | .44 |

Sources: FIBGE, *Produção Industrial*, 1969; and *idem*, *Censo Demográfico*, 1970.

Note: The numbers between parentheses are the coeficients of variation. The variables in the columns of the table were defined as follows: average annual productivity = VIT/industrial employment; average annual wage = annual wage bill/industrial employment; surplus = (VIT — annual wage bill)/industrial employment; degree of industrialization = 100. Industrial employment/urban population; degree of industrial specialization = employment (or VIT) in the four largest industries/industrial employment (or VIT); degree of specialization in traditional industries = employment in traditional industries/industrial employment. The traditional industries are: textiles, leather products, furniture, wearing apparel, beverages, tobacco, publishing and printing, and food products. Percentage share of large firms = employment (or VIT) in firms with more then 500 employees/total industrial employment (or total VIT).

metropolitan areas indicates the effect not only of the low efficiency of these areas, but also of the weight of the poor and little industrialized centers in their peripheries.

The average productivity of labor is mainly a function of two explanatory factors: the capital intensity of the technology, represented by the capital/labor ratio, and the external or agglomeration economies.[20]

Given the lack of complete statistics on capital, the installed-electric-power capacity/number of workers ratio is commonly used in studies on the Brazilian economy as a proxy for the capital/labor ratio. However, for 1969 even this information is not available at the city level. As a second alternative, the surplus, calculated as the difference between the average

average productivity to urban population ratio in Brazil. The results are insignificant for all classes below 200 thousand inhabitants. For the classes 200-500 thousand and 500 thousand and over, the parameters are significant at 5%, having coefficients of determination of 53% and 69%, respectively. In these equations, the urban population exponent measures the average elasticity of productivity in relation to urban size. In the class 200-500 thousand, this elasticity is 1.56, which indicates a convex curve. In the class 500 thousand and over, the elasticity is .29; that is, the curve is concave. In other words, these results show that average productivity increases more than proportionally for cities with more than 200 thousand inhabitants, and less than proportionally for cities with more than 500 thousand. This suggests that in the latter class the net economies (economies minus diseconomies) of agglomeration decrease with urban size.

[20] Implicitly, we are reasoning on the basis of a production function for each city, in the generic form $X = f(K, L)\ h(N)$; where $X$ = product, $K$ = capital, $L$ = labor and $h(N)$ is a function representing the agglomeration economies, where $N$ = the size of the city. The effects of these economies are of the neutral technological progress type. Specified as a Cobb-Doublas function, this may he expressed

$$X = h(N)\ (K^a, L^b) \text{ or } \frac{K}{L} = h(N)\left(\frac{K}{L}\right)^a L^{(b+a-1)}, \text{ or}$$

$$\log \frac{X}{L} \quad \log h(N) + a \log \left(\frac{K}{L}\right) + (b + a - 1) \log L$$

The CES production function can also he linearized to yield

$$\log \frac{X}{L} \; I \; g_o + g_1 \log L + \log \frac{K}{L} + g_2 \left(\log \frac{K}{L}\right)^2, \text{ where the}$$

coefficients $g$ are algebraic expressions of the CES parameters, including that of the function $h(N)$. See Z. Griliches and V. Ringstad, *Economies of Scale and the Form of the Production Function* (Amsterdam: North Holland Publishing Co., 1971), ch. 2.

productivity and the average wage rate, can be tentatively interpreted as the sum of resources available for investment per person employed, that is, as a proxy for the marginal capital/labor ratio. There exist, however, some problems with this interpretation. On the one hand, this surplus includes distributed profits, which are not necessarily invested. On the other hand, in order that the surplus may adequately represent the marginal capital/labor ratio, it is necessary to assume that the resources generated within an urban class are totally invested in the same class. In fact, this is a fundamental hypothesis, but a rarely studied aspect of the urban development process. Questions related to the transfer of resources for investment from one class to another are basic to the formulation of an urban development policy.[21] In the case, for example, of a strong polarization effect, any attempt to concentrate investments in intermediate centers or distribute them among small cities will ultimately result in their being channeled, in whole or in part, toward the primate cities.[22]

Table 4 shows that in Brazil the surplus increases with urban size, which, *coeteris paribus,* indicates that more capital-intensive methods of production are used as the size of the city increases.

The existence of agglomeration economies is a second important factor in characterizing the degree of efficiency of a city. It is commonly argued that small cities lack these economies, while the large metropolitan areas show signs of diseconomies and congestion. Though still in an aggregate and not yet satisfactory form, Table 4 brings together a set of indexes that make it possible to distinguish the cities according to the level of the agglomeration economies.[23]

The degree of industrialization, in the fourth column, was obtained by dividing industrial employment by urban population. Thus, it is an index of the importance of the

[21] These interclass movements of capital represent a special case of the so-called "polarization" (or "centripetal") effect. The effect in the opposite direction is termed "trickling down" (or "centrifugal"). Both are extensively discussed by Hirschman, Myrdal and Perroux; see Hirschman, ch. 10.

[22] This process obviously involves a time lag, the duration of which varies according to the production structure and elasticities of demand in each class. The extent of these transfers will likewise be a function of this structure.

[23] The agglomeration economies can be subdivided into economies of scale (when internal to the firm), localization economies (when internal to an industry or sector), and economies of urbanization (when arising from increasing returns with the size of the city). See W. Isard, Location and space *Economy* (Cambridge: MIT Press, 1959), ch. 8.

industrial sector in a given city or class of cities.[24] The degree of specialization, in the fifth and sixth columns, is a measure of the employment and VIT concentration in the four most important branches of industry. Clearly, the four most important with respect to employment are not necessarily the most important with respect to VIT. The seventh column characterizes the specialization of the urban centers in terms of industries considered traditional in the Brazilian context (see note to Table 4). This industrial group generally shows different locational patterns, regional or local markets, and not very significant localization economies and economies of scale. A high degree of specialization joined to a low degree of specialization in traditional subsectors can be interpreted as an indication of localization economies. Finally, the last two columns show the share of the large firms in total employment and VIT. A high share is associated with the presence of important indivisibilities and economies of scale.

Interpretation of these indexes permits the drawing of some interesting conclusions concerning the recent structure of the Brazilian urban-industrial system. To begin with, the degree of specialization and the index of economies of scale do not differ significantly when calculated by VIT or by employment. The divergence tends to be greater in the case of the large metropolitan areas, reflecting the greater use of capital, and consequently the high productivity in these cities.

Considering all the classes, the differences among cities, measured by the coefficient of variation, are greater in terms of average productivity than in terms of average wages, which demonstrates the importance of institutional factors such as minimum legal wage rates and union negotiations. The large centers show greater dispersion with respect to productivity, while the intermediate class A centers reveal greater dispersion with respect to wages. From the static point of view, the coefficients of variation indicate that the cities become similar as their size increases.

In summary, as the cities rise in the urban hierarchy, the importance of the industrial sector increases. That this importance is not only quantitative is confirmed by the degree of

24 Manpower would be a more appropriate variable for denominating the index, since it gives a more accurate idea of the labor supply. In certain cases, it is desirable to weight the index with the rate of unemployment in order to approach the problem from the point of view of the demand for this factor. Ideally, the value added would be a better measure than employment for determining the degree of industrialization, since it automatically incorporates the productivity differentials among cities.

industrialization. Above all, it is qualitative, as proven by its induced effects not only on the tertiary sector, but also on the primary sector, through the demand for agricultural inputs. With the growth of urban size, the industrial structure becomes progressively more diversified, as can be seen from the specialization index. Such specialization works against the traditional industries and in favor of those that produce consumer durables and intermediate and capital goods. The latter, in turn, are more subject to important indivisibilities and economies of scale, an observation which is supported by the share of the large firms in total employment and product.

There exist, nonetheless, some exceptions that deserve special comment. The first concerns the importance of economies of scale in the intermediate class A centers. In these centers, the shares of the large firms in employment and product are nearly equal to those observed in the large metropolitan areas. The relatively low value of average productivity in the class may be the result of the coexistence of traditional industries and large firms in the durable and capital goods sectors, these being subject to economies of scale.

A second exception is the abnormally low degree of industrialization in the large centers, for which the value is 1.7 compared to the national average of 3.8. In fact, this phenomenon is still to be satisfactorily explained. Among the possible causes might be an especially high participation of the service sector in the creation of employment in these cities. Another fact which deserves mention is the stability (at around 51%) of the index of specialization in traditional industries for the cities in the class interval of 100 thousand to 2 million inhabitants.

Another basic question concerning the urban growth process is the manner in which the remuneration of the production factors varies with the size of the cities. The comparative advantages of cities with respect to each factor can be determined as a function of such variations. In the case of capital, it is assumed that, owing to its mobility, the rate of interest does not vary with the urban size. However, the same is not true of the other factors of production. Theoretical and empirical studies indicate, for example, that rent is a rising and concave function of urban size.[25]

The evidence in Table 4 shows that, in Brazil, the average wage is actually a rising function of the scale of cities. Evans argues that wage increases are the principal form of compensating

25 See A. W. Evans, "The Pure Theory of City Size in an Industrial Economy," *Urban Studies* 9, n.º 1 (February 1972): 51-53.

the individual for increasing expenditures on rent and urban transport.[26] Of course, there may exist other forms of tangible compensation, such as recreation and specialized services, as well as intangible forms, such as the cultural environment of a large city. However, Evans goes further and suggests that wages increase with urban size at a decreasing rate, that is, that the curve is concave. The explanation is based on the following argument: the population of a city is proportional to its area and therefore to the square of its radius, while rents and transport costs are proportional to the radius of the city and therefore to the square root of the area. Thus, the wage increase necessary to compensate for additional expenditures on rents and urban transport will be progressively smaller as the city grows in size. However, in the Brazilian urban system, contrary to the theory, the wage curve is convex [27] (see Table 4) . Moreover, Evans presupposes an efficient transport system to be a corollary of economies of scale. But in Brazil, high densities, congestion, and, above all, the inefficiency of urban transport can make rents and transport costs increase at rates accompanying urban size; hence, the wage curve will be convex.

Considering the above, and partially adopting the urban size model — that is, taking into account only the generation of product and overlooking cost considerations — it may be concluded that cities become economically more efficient as their size increases. Such efficiency is derived principally from the agglomeration economies, though other factors not mentioned, such as amenities and ease of contacts and communication,[28] may also be important.

## 5 — INCOME DISTRIBUTION, DEMAND STRUCTURE AND URBAN SIZE

In this section two questions of great relevance for the definition of an urban development policy are considered. The first concerns the extent to which gains in efficiency are

[26] *Ibid.*, pp. 54-55. In perfect competition, the wage is equal to the value of the marginal productivity of labor. In reality, the wage rate maintains a close relation to marginal productivity, though it is also influenced by institutional factors and, as Evans asserts, by diseconomies of agglomeration (rise in the cost of living).

[27] It is true, however, that the convexity may be due to the class intervals used; that is, the form of the curve may be affected by different intervals.

[28] R. Meier, *A Communications Theory of Urban Growth* (Cambridge: MIT Press, 1962).

obtained at the cost of a reduction in intra-urban equity. The second concerns the structure of demand, or rather, the changes in the composition of household budgets by urban size class.

The conflict between the objectives of efficiency and equity has been studied extensively.[20] In general, efficiency is measured by the growth of per capita product, and equity defined as better distribution of income. Theoretically, in developing countries a policy favoring equity should imply an opportunity cost in terms of efficiency. Vice versa, one could say that a strategy of spatial concentration should determine a cost in terms of equity. This conflict would cease to exist only in the long run, when the economy reached high levels of development.[30]

At the intra-urban level, greater employment opportunities and the diversified economy of the large cities determine, in principle, a more equitable distribution of income. At least, this seems to be the case of the United States[31] and other industrialized countries.

In the urban sector of Brazil, the degree of concentration of personal income rose during the sixties, the Gini coefficient increasing from .48 in 1960 to .55 in 1970, i.e., nearly 15% over the period.[32]

Little information is available on the concentration of income at the intra-urban level, and it refers to only a few cities.

20 See, for example, W. Alonso, "Urban and Regional Imbalances in Economic Development," *Economic Development and Cultural Change* 17, n.º 1 (October 1968): 1-14; *idem, Equity and Its Relation to Efficiency in Urbanization*, Working Paper, n.º 78 (Berkeley: University of California, Center for Planning and Development Research, June 1968).

30 See Alonso, "Urban and Regional Imbalances," pp. 9-10; and J. G. Williamson, "Regional Inequality and the Process of National Development," *Economic Development and Cultural Change* 13, n.º 4 (July 1965): 3-45.

31 Empirically, the question of equity has most often been studied at the regional and national levels. There are fewer intra-urban studies; among the more recent stands out that by O. A. Ornatti: "Poverty in Cities," in *Issues in Urban Economics*, ed. H. Perloff and L. Wingo (Baltimore: The Johns Hopkins Press, 1968), pp. 335-62. Evans cites a study by M. Farbman, whose conclusion — that inequalities of income increase with urban size — opposes that of Ornatti. "The Pure Theory of City Size," pp. 55-56.

32 Other indexes of concentration confirm this result. That of Thiel goes from .42 to .47 (+ 36%), and the variance of the logs from .79 to 1.03 (+ 30%). The concentration of income is appreciably higher in the urban sector than in the primary sector; for the latter, the Gini coefficient rises from .42 in 1960 to .44 in 1970 (+ 4.7%). In the same period, the average monthly revenue of the cities increased 38.4%. Data compiled by C. G. Langoni, "Distribuição da Renda e Desenvolvimento Econômico do Brasil," *Estudos Econômicos* 2, n.º 5 (1972): 5-88.

The best data for the study of this problem in Brazil is that provided by the FGV research on family budgets done in 1961, 1962 and 1963.[33] Although nor very recent, these statistics are comparable among themselves, and, of the various sources,[34] cover the greatest number of cities in the country. The research sample includes all the metropolitan areas (only the *municípios* of the capitals) except Porto Alegre, as well as 49 other cities in the states of São Paulo, Minas Gerais, Rio de Janeiro, Espírito Santo, Paraná and Santa Catarina. The family budget data for the *municípios* other than those of the capitals are furnished by groups of *municípios* classified by urban size. However, since these classes do not always correspond to the size classes adopted in the present study,[35] it was occasionally necessary to use other criteria so that the two classifications would coincide. For this reason, it was also impossible to differentiate class A and class B intermediate centers; these were therefore consolidated in one single class.

For several reasons — from the point of view of demand, for example — it is preferable to use the family instead of the individual as the unit of observation. As the family is the basic unit of consumption, the composition of current expenditures commonly refers to family expenses. By the same token, it is desirable to express in family terms the data on income and its distribution. In Table 5, income is measured net of income tax and social security contributions in order to make it comparable to current expenditures, which include what the family spends for its daily maintenance. In addition, it should be noted that family income is usually better distributed than personal income.

It can be observed from Table 5 that the average family income increases approximately 52% from the smallest to the largest urban size class. Considering only the class of intermediate cities and up, it is interesting to note that family income and average industrial productivity (see Table 4) reveal rather similar

33 Fundação Getulio Vargas — FGV, *Pesquisa sobre Orçamentos Familiares*, 1961, 1962 and 1963.

34 These include, for example, the research on the consumption of manufactured products carried out by the Banco do Nordeste do Brasil — BNB in various cities of the Northeast, and the study by C. V. Cavalcanti, "A Renda Familiar e por Habitante na Cidade do Recife," *Pesquisa e Planejamento Econômico* 2, n.º 1 (June 1972): 81-104.

35 The research on the capitals was done between July 1961 and June 1962, and that on other cities between July 1962 and June 1963. For the calculation of the Gini coefficients, the data were not deflated. To deflate (from 1962-1963 to 1961-1962) the average family income in the other cities, a wholesale price index was used.

behavior. Both variables reach their minimum value in the secondary metropolitan areas. The maximum differentials are 50% for income and 60% for productivity, both occurring in Rio-São Paulo and the other metropolitan areas. In this comparison, the intermediate cities once again stand out as a special case. Normally, income level, productivity and degree of industrialization are closely associated variables.[30] In fact, within the urban system, the intermediate cities occupy second place in terms of family income and degree of industrialization and third place in

Table 5

*Level and Distribution of Family Income by Urban Size Class, 1961-1963*

| Urban Size Class (1 000 Inhabitants) | Annual Average Family Income (Cr$ 1 000. at 1961-1962 Prices) | Gini Coefficient |
|---|---|---|
| Less than 50 | 432.6 (.09) | .42 |
| 50 — 250 | 508.5 (.10) | .40 |
| 250 — 500 | 466.0 (.12) | .43 |
| 500 — 2 000 | 441.0 (.01) | .44 |
| 2 000 and over | 661.5 (.005) | .44 |

Source: FGV, *Pesquisa sobre Orçamentos Familiares*, 1961, 1962 and 1963. The data on state capitals refer to the period June 1961 – July 1962, and those on other *municípios* to the period June 1962 — July 1963.

Note: The numbers between parentheses are the coefficients of variation for the respective urban classes.

productivity. It should be pointed out that the majority of these cities are located in the Southeast and South regions of the country, near the metropolitan areas that constitute the principal market for industrial goods.

Generally speaking, productivity differentials are greater than family income differentials. Family income is a broad concept that considers remuneration of production factors other than labor and sectors other than industry. Thus, indications are that

30 See I. Hoch, "Income and City Size," *Urban Studies* 9, n.º 3 (October 1972): 299-328.

the same phenomenon observed for the urban sector as a whole (see section 2 above) also occurs at the disaggregate level of urban size class. That is, the tertiary activities lessen the differences in industrial productivity; consequently, in comparison to productivity, family income shows not only lower interclass differentials, but also greatly reduced coefficients of variation.

In short, setting aside questions of cost, both average family income and industrial productivity can be used as indexes of the economic efficiency of a city.

Next, moving to the distribution of family income, one observes in Table 5 that the Gini coefficient remains practically unchanged for different classes of urban size. The interquartile deviation, another indicator of income inequality, also appears insensitive to the scale of cities.[37]

As previously mentioned, the experience of other countries, especially the developed ones, points in the direction of a reduction in the concentration of income as cities increase in size. However, in view of the results presented in Table 5, one might ask to what point this behavior may be generalized for the less developed countries, and particularly for Brazil. It is quite possible that aggregation by size class conceals important differences in the concentration of intra-urban income. Research also remains to be done as to the factors explaining these variations. Obviously, these are complex questions requiring much more extensive and in-depth research than is possible with the statistical information now available. However, one way of ascertaining the existence of variations (in the level and distribution of family income) hidden by aggregation is through multiple regression analysis.

Given the limitations of the data, the analysis presented here[38] gives greater emphasis to the specification of the family

[37] The calculations made in the present study show that the interquartile deviation has the values .48, .47, .48, .50 and .46, from the smallest to the largest class of Brazilian cities.

[38] 20 cities (eight state capitals and 12 other cities) were selected from the FGV *Orçamentos Familiares* (family budgets). The following variables were subsequently calculated from these budgets: family income, Gini coefficient, interquartile deviation, average number of persons working per family, and education of the head of household. The degree of industrialization and the share of industries considered dynamic were based on IBGE, *Produção Industrial*, 1969. For the urban population, specifications were tested using 1970 data on population and migration and 1960 and 1970 census data on industrialization. For the specifications involving 1970 population and migration statistics and 1969 industrialization statistics, it was necessary to assume that the relative intercity family income differentials and the Gini coefficients, both calculated for the period 1961-1963, remained unchanged up to the end of the decade.

income equations, its theoretical basis, the discussion of the sign and the definition of the independent variables than to strictly econometric questions. Generally speaking, the statistical results should be interpreted with due caution, ultimately being indications for future research and discussion rather than definitive conclusions.

In the income equation, the average annual family income is specified as a function of two principal factors: industrialization and migration. To represent the phenomenon of industrialization at the urban level, two variables were defined for each city: a) the degree of industrialization, calculated as the ratio between employment in the manufacturing industries and the urban population, that is, as a generic measure of the importance of the secondary sector in a city; and b) a variable representative of the composition or industrial structure of the city, measured by the percentage share of the dynamic industries[39] in the overall annual wage bill of the manufacturing industries.

Analogously, the effect of migration is represented in the family income equation by two variables with distinct roles: the first shows the pressure of the migratory flows in general, while the second reflects the composition of these flows. In view of the unavailability of data on migration at the level of the urban center, the above variables were calculated for 10 regions.[40] This procedure presupposes that all the cities within the same region are equally affected by migratory movements.

The migratory pressure (MIG) variable for region $i$ is defined as

$$\text{MIG} = \frac{\text{INTRA MIG} + \text{INTER MIG}}{\text{Urban Population}}$$

In the numerator, INTRA MIG is the sum of net intraregional rural-urban migration (that is, rural-urban minus urban-rural) plus urban-urban migration. In turn, INTER MIG is the sum of inmigration to and outmigration[41] from region $i$. In these

39 The following industries were defined as dynamic: nonmetallic minerals, metallurgy, nonelectrical equipment, transport equipment, electrical equipment, chemicals, paper and paper products, and plastics.

40 The migration data was taken from M. da Mata, E. Werneck and M. T. Castro e Silva, *Migrações Internas no Brasil: Aspectos Econômicos e Demográficos*, Relatório de Pesquisa, n.º 19 (Rio de Janeiro: IPEA/INPES, 1973).

41 The criterion for classifying the census regions as regions of inmigration or outmigration depends on the sign of the net interregional migrations and on per capita income. High per capita income and a positive sign characterize a region of inmigration, while low income and a negative sign indicate a region of outmigration. See M. da Mata *et al.*, ch. 3.

calculations, the negative sign indicating an outmigrational movement is simply disregarded. Assuming that the inmigration and outmigration occur at the same moment in time, that is, simultaneously, the variable MIG can be interpreted as the probability of an urban resident, taken at random, making a migratory movement.[42]

The variable for the composition of the migratory flows (MA) in region *i* indicates the importance of intraregional relative to interregional migrations and is defined as

$$MA \quad \frac{(\text{INTRA MIG in i}) \div (\text{INTRA MIG BRAZIL})}{(\text{net INTER MIG in i}) \div (\text{net INTER MIG BRAZIL})}$$

The numerator measures the share of region *i* in the total intraregional movements in Brazil. As in the previous variable, urban-urban and net rural-urban movements are included in INTRA MIG. The denominator measures the share of region *i* in the total interregional migrations. However, the sign of the flows now has an important role, since a negative sign means a region of net outmigration, while a positive sign indicates a region of net inmigration. INTER MIG is measured by the net rural-urban and urban-urban migrations in region *i*, accompanied by the respective sign. In turn, INTER MIG BRAZIL is equal to the sum of the absolute values of the net interregional migration for each region.

The variables having been defined, the multiple regression analysis may now be considered. Family income (FI) is defined as a function of the following variables: degree of industrialization (DI), share of the dynamic industries in the sectoral wage bill (SD) and pressure (MIG) and composition (MA) of migrations. Of these four variables, two, DI and MA, are significant at 1% and 5%, respectively. The others, though not significant, should be discussed due to the implications of their sign.

The resulting income equation is

$$\begin{array}{lcl} & (.757) \quad (.374) & \\ FI \quad 393.82 + 45.22\ DI + 32.17\ MA & & R^2 = .66 \\ & (4.566) \quad (2.487) & \end{array}$$

42 Strictly speaking, this interpretation requires that the total interregional outmigration from region *i* be added to the denominator.

The numbers between parentheses below the parameters are the respective values of $t$, and those above the values of beta.[43]

In accordance with the theory, family income is positively related to the degree of industrialization of the city. Greater industrialization means higher productivity, higher wages, and, therefore, higher family income. The variable SD, though not significant, is positively related to the level of income. Within the secondary sector, the dynamic industries are, by definition, above the average in terms of productivity and product growth. In contrast, these industries have much less importance with regard to labor absorption. It can therefore be concluded that the role of SD is to reinforce the positive effect of DI on family income. In part, the nonsignificance of SD is due to its multicollinearity with DI; the coefficient of simple correlation between these two variables is .437.[44]

The composition of the migratory flows (MA) is the second significant variable in the income equation. The value of $t$ indicates significance at 5% by a wide margin, reaching nearly 1%. However, the cause-and-effect relationship being much more difficult to interpret in this case, it is best presented graphically as in Figure 2.

The variable MA assumes positive values in the regions of inmigration and negative values in the regions of outmigration. The figure further suggests that *inter* and intraregional migrations influence the level of income differently according to the type of region. In the regions of inmigration, the *intra* movements affect family income positively; in the regions of outmigration, precisely the opposite occurs. In turn, the *inter* migrations contribute to increasing income in the regions of outmigration and reducing it in those of inmigration.

Generally speaking, four cases can be distinguished in the figure. In sections A and D, the absolute value of MA is greater than unity, that is, $MA > 1$, implying a greater relative importance of intraregional movements. In sections B and C, $0 < MA < 1$ indicates the dominance of interregional migrations. However, an important clarification must be made here with respect to interregional migrations. In the definition of the variable MA, these flows are measured by the net migration for

43 The Beta coefficient, or normalized regression coefficient, was obtained by multiplying the value of the parameter by the standard deviation of the respective independent variable to standard deviation of the dependent variable ratio.

44 The urban population is also insignificant, due to the multicollinearity with DI.

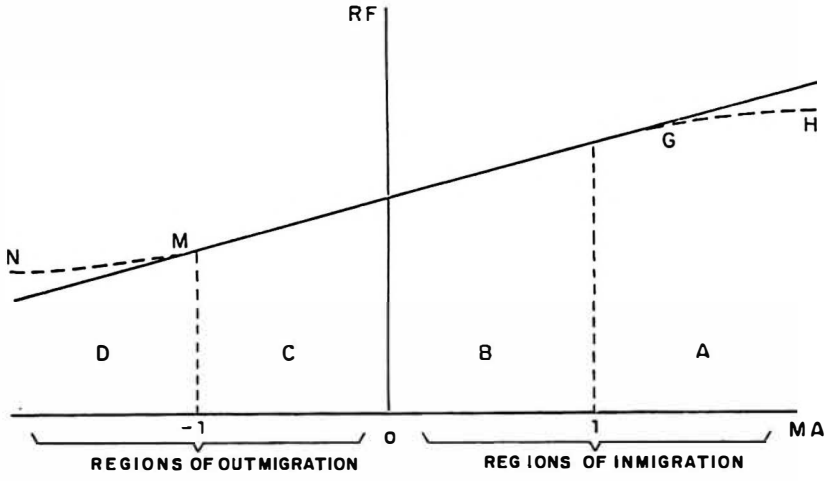


FIGURE 2 – EFFECT OF THE COMPOSITION OF MIGRATORY MOVEMENTS ON FAMILY INCOME

each region; consequently, they have different implications depending on the region. In the regions of inmigration they denote an increase in the supply of labor, but in those of outmigration they indicate a decrease.

In the paragraphs that follow, it is once again fitting to call the attention of the reader to the precariousnes of the theoretical, and empirical, basis of some of the propositions used to explain the effects of migratory flows. It should be evident, for example, that commonly accepted models such as the neoclassical are based on overly restrictive hypotheses. The neoclassical model of economic growth affirms that the decision to migrate is a direct function of regional income differentials. Some variations of this model also include among the variables explaining migration the information available to the potential migrant concerning the conditions of the labor market in the region of destination. These conditions are represented, for example, by the probability of finding employment in the modern sector of that region, or by the number of persons proceeding from the same region of origin.[45] In the specification of the family income equation, it is assumed

45 In this context, see M. P. Todaro, "A Model of Labor Migration and Urban Unemployment in Less Developed Countries," *American Economic Review* 59 (March 1969): 138-47; and M. J. Greenwood, "Lagged Response in the Decision to Migrate," *Journal of Regional Science* 10 (December 1970): 375-84.

that the migrant has not only decided to move to another region, but that he is already in the region or urban center of destination. It is therefore sought to determine the effect of his presence on the average income in the region of destination. In a dynamic approach, once new levels of income are reached, new decisions to migrate will follow until a new equilibrium is attained.[46]

Returning to Figure 2, one observes that in section A of the regions of inmigration, the level of family income varies in direct proportion to the relative importance of the intraregional movements. According to neoclassical theory, the reallocation of labor among regions or within the same region should lead to an increase in wages in the region of origin and reductions in the areas or urban centers of destination, eventually leading to the equalization of the factor prices. However, what is observed in practice is the existence of wage and income differentials; and, more important yet, these differentials do not appear to reveal any tendency to diminish. The principle of factor price equalization[47] is based on hypotheses such as linear and homogeneous production functions, identical production functions for the various regions, absence of transportation costs, incomplete specialization of production in each region, perfect competition, remuneration of the factors according to the value of marginal productivity, a limited number of products and factors, and so forth. If these hypotheses are not observed, the equalization of factor prices will only be partial.[48] In questions of urban economics, it is essential that some of these hypotheses be disregarded so as to be able to explain the behavior of the economic agents in space, or even to justify the existence of cities, as in the case of agglomeration economies and transportation costs. The locational decisions of entrepreneurs and consumers depend on transportation costs for raw materials and consumer products. With increasing returns to scale (agglomeration

[46] In the neoclassical model, the point of equilibrium is defined by the equalization of the regional incomes (or wages); that is, the income differentials tend to zero. In the variations of the model, the problem of determining the point of equilibrium becomes much more complicated, there being no certainty that it exists.

[47] This is the basic principle of the Heckscher-Ohlin theory, later proved with exactness by Samuelson. See P. A. Samuelson, "International Trade and Equalization of Factor Prices," *Economic Journal* 58 (June 1948): 163-84; J. Bhagwati, "The Pure Theory of International Trade: A Survey," *Economic Journal* 74 (March 1964): section 2; and H. W. Richardson, *Regional Economics* (London: Weidenfeld and Nicholson, 1969), ch. 12.

[48] In the case of labor, other causes of a psychological and social nature contribute to the inertia of the potential migrants. See Richardson, *Regional Economics*, ch. 12.

economies), factor price differentials may widen rather than narrow.[49] It was also verified earlier that cities show great differences in specialization. The intermediate centers, for example, are highly specialized, and some small cities have only one industry, which directly contradicts the hypothesis of incomplete specialization. In addition, labor is not a homogeneous factor. The great differences in degree of qualification give rise to wage differentials among cities which are distinctly specialized in terms of industry. In turn, these cities require manpower having different skills.

A rapid examination of the data on average family income by city shows that various intermediate centers and some large centers in the Southeast and the South have income levels equivalent to or higher than those of the metropolitan areas in the respective region. In other words, these centers should be placed in section A of the figure. In Brazil the intermediate class A cities were outstanding labor absorbers during the sixties. This means that, although the inflow of migrants implied a rightward shift of the labor supply curve, the growth of demand in these centers was even greater, determining a rise in the average wage rate and, therefore, in family income.[50]

The impact of migrations on income level also depends on the proportion of migrants and nonmigrants in total urban population. In this country, it was observed in 1970 that of the intraregional migrants who had moved to the cities, approximately 40% had been living for less than five years in the place of destination. These persons are here considered new migrants. This proportion was slightly higher in the regions of inmigration, where the urban-urban type also dominates, with approximately 80% of the total. As a rule, the new migrants exert a depressive effect on income. In the regions of inmigration, the family income of the new migrants was only approximately 70% that of the migrants considered old (more than 10 years' residence). However, section A of the figure indicates that this effect is compensated for by a more than proportional shift in the demand curve.

[49] N. Laing, "Factor Price Equalization in International Trade and Returns to Scale," *Economic Record* 37 (September 1961): 339-51.

[50] It should be observed that throughout this discussion it is assumed that a rise in the average wage results in an increase in per capita or family income. Despite the fact that wages account for a large share of family income, this income includes other sources that are often important in a comparison between migrants and nonmigrants. Such, for example, is the case of income generated by the members of the family who work.

In section B of the figure, the interregional flows dominate. Generally speaking, the interregional migrant has a per capita income level that is higher than the average in his region of origin and lower than that in the region of destination. Thus, to the extent that interregional migrants go to metropolitan areas in the regions of inmigration, the average income tends to decrease in these areas. The model developed by Todaro [51] is most often applied in such cases. The potential migrant bases his decision on the "expected income" in the region of destination or, more precisely, on the current income weighted by the probability of obtaining employment in the modern sector of the economy. Insofar as this probability is small, contingents of unemployed or underemployed are formed, generally in the traditional tertiary sector of the metropolitan areas, thereby lowering the average income.

Summarizing the case of the regions of inmigration, it may be concluded that the intermediate and large centers and the metropolitan areas are distributed around MA = 1, with a dominance of the first two in section A and of the metropolitan areas in section B. Presumably, the small cities would be placed near zero. Furthermore, it should be pointed out that the increase in family income from section B to section A tends to overestimate the actual differentials, suggesting a slight inflection of the curve downward, as indicated by the broken line GH.

In the regions of outmigration, the situation appears to be much more complex. On the one hand, since the straight line adjusted for family income takes into consideration only the principal cities of the Northeast, there may be a bias with regard to the smaller cities. On the other hand, for each type of migration, *intra* and interregional, there are two forces acting in opposite directions. Regions of outmigration are usually areas having a relative surplus of labor, a greater number of workers being in a regime of disguised unemployment. Thus, in section C the net outmigration would tend to increase productivity and family income. At the same time, since migrants are more capable individuals with incomes above the average in the region of origin, their exit should have the opposite effect of lowering this average (i.e., selective effect).

The shape of the curve suggests that family income rises with interregional outmigration. Therefore, although selectivity exists, it tends to be relatively less important than the reduction in disguised unemployment. However, another question remains

51 "A Model of Labor Migration."

open: the exact place of origin of these flows is not known. Do they originate in the metropolitan areas or in the smaller cities? It is plausible that, in most cases, the first occurs; that is, interregional flows should originate in the metropolitan areas of the regions of outmigration, and have their destination in the corresponding centers in the regions of inmigration. In terms of the figure, this means that the metropolitan areas would be grouped in section C, possibly near zero.

In section D, the income level varies inversely with the importance of the intraregional flows; and, as in the previous section, there are two forces acting in opposite directions. On the one hand, the reduction of underemployment tends to raise average income in the country (rural-urban flow) and in the urban centers of origin (urban-rural and urban-urban flows). On the other hand, to the extent that the intraregional migrants in the regions of outmigration have a very low level of income, their presence depresses average income in the areas of destination. Granting, further, that the intraregional movements are directed towards the smaller centers, these centers will be distributed on section D in the figure. However, contrary to what was observed in relation to the regions of inmigration, the curve should now show an inflection along the broken line MN, indicating that the estimated differentials (from section D to C) overestimate the actual values.

From the above discussion emerges a proposition which, despite lacking additional empirical support, is of great importance for defining a national urban development policy. It seems plausible to assume that, in the first stage, the *intra* migrants go to the smaller cities and the *inter* migrants to the larger ones. The explanation lies in the amount of information that the migrant has about the work conditions in the place of destination. The rural-urban intraregional migrant moves to the city owing to dissatisfaction with the fields, and his destination is a small center because, in addition to being nearer, it is where he encounters his contacts and friends. In turn, the urban-urban interregional migrant moves because of dissatisfaction with his region or else because of the attraction exerted by the large centers. Yet, in both cases the *inter* migrant tends to have more information than the *intra* migrant. In some intermediate situations, such as urban-urban intraregional movements, the dichotomy is not so clear. This is explained by the complete absence of disaggregate information for classes of cities.

It still remains to comment on the role of the migratory pressure (MIG) variable in the income equation. In this case,

the negative sign is due to the dominance of new migrants, who account for between 35% and 40% of the total migration in the country. In 1970, the ratio of the income of old migrants to that of new migrants was 1.43 in the regions of inmigration and 1.23 in those of outmigration. In addition, open unemployment was higher for the new group, being 3.6% compared to 2.4% for the old group and 3.3% for the total labor force. The variables MIG and MA are calculated as cumulative migratory flows; thus, if migrations decelerate in the future, either spontaneously or due to governmental policy, the MIG sign should change from negative to positive. Such a change would reflect the great adaptation capacity of the migrants. In other words, it should indicate that the average family income of the migrant is directly proportional to his length of residence in the place of destination.

The results obtained by adjusting the equation for the distribution of family income are statistically less than satisfactory. Various alternative specifications were tested, having as the dependent variable the Gini coefficient (GC) or the interquartile deviation (ID), and as the independent variables urban population, degree of industrialization (DI), participation of the dynamic industries (SD), average family income (FI) and migratory pressure (MIG) and composition (MA). The coefficients of determination obtained are systematically low, explaining at the most 20% of the total variance. In large part, this is due to the slight variance of the income distribution index used. The coefficient of variation of GC is only 7.5%, and that of ID is 10.6%. Under these conditions, the number of observations should be expanded far beyond the 20 cities studied so as to obtain statistically more significant results. The income distribution equation obtained is: [52]

$$\begin{matrix} & (-0.606) & (.512) & (.329) \\ GC = 35.85 - & .009FI & + .50DI & + 13.95\ MIG;\ R^2 = .194 \\ & (-1.945) & (1.810) & (1.799) \end{matrix}$$

The nonsignificance of urban population confirms the results of Table 5; that is, the distribution of income does not vary with the size of the city. The family income and degree of industrialization variables are significant only at 10%. According to the values of the Beta coefficients, family income is the most

[52] In order to present the results, the income distribution equation was multiplied by 100, so as to reduce the number of zeros in the values of the parameters.

important explanatory variable, followed by DI and MIG. Increases in FI tend to reduce income inequalities, while DI and MIG reinforce them. Nevertheless, the role of FI in the equation is closely related to the interpretation of DI, which means that FI captures part of the effects of DI on the distribution of income.[53] The multicollinearity between these two variables is also responsible for the low level of significance obtained — only 10%.

The degree of industrialization is positively correlated with average family income and inversely correlated with the equity of the distribution of income. This apparently contradictory phenomenon seems to be characteristic of countries in the intermediate stages of industrialization. Industrial specialization normally implies a high capital to worker ratio, high productivity and more qualified labor. The relatively limited range of qualifications demanded by industry in developing countries leads to an increase in income inequalities. In terms of the human capital theory, these inequalities are related to the average level of investment in human capital and to its rate of return.[54]

It is also known that the industrial structure of the city conditions the opportunities, as well as the type and period of training, of labor. For example, an industrial structure that pays high initial wages increases foregone income, raising the cost of investing in human capital and thus reducing the rate of return. The final result is an increase in average income and less inequality. By conditioning the attitudes of the entrepreneurs to risk, the industrial structure can also affect the distribution of interest, profits and rents.

Increments in average family income can also mean greater investments in urban social infrastructure, thereby constituting an important factor in the redistribution of real income and equalization of opportunities.[55] Another possible interpretation is that the increase in the relative importance of the service sector in the large metropolitan areas has a positive effect on distribution.

Migratory pressure (MIG) is the third significant variable in the distribution of income equation. The positive sign clearly

53 See J. M. Mattila and W. R. Thompson, "Toward an Econometric Model of Urban Economic Development," in *Issues in Urban Economics*, ed. Perloff and Wingo, pp. 63-80; B. B. Murray, "Metropolitan Interpersonal Income Inequality," *Land Economics* 45 (February 1969): 121-25; and H. E. Frech and L. S. Burns, "Metropolitan Interpersonal Income Inequality: A Comment," *Land Economics* 47 (February 1971): 104-106.

54 See T. W. Schultz, *Investment in Human Capital* (New York: The Free Press, 1971).

55 Mattila and Thompson, p. 67.

shows that the dominance of new migrants tends to widen income inequalities. In 1970, 57.8% of the new migrants were receiving a monthly income equal to or less than the legal minimum wage, [56] compared to 51.9% of the migrants with between five and 10 years' residence and 45.1% of those with more than 10 years. By sector of activity, it was observed that in services 86% of the new migrants and 75% of the old migrants were receiving a monthly income equal to or less than the legal minimum wage, certainly in conditions of underemployment. In commerce these percentages were 56% and 42%, while in industry they were 54% and 45% for the new and old migrants, respectively.

Throughout the above discussion it has been taken for granted that wages comprise the major portion of the functional distribution of income. This being so, the share of wages must be considered in estimating the final effects on total income of any redistributive policy that favors labor. In 1960, the most recent year for which there is complete information on functional distribution of income in the national accounts, wages accounted for approximately 60% of the national income of Brazil. More recent information, through limited to industry, indicates an average share of nearly 40% in the period 1966-1969. However, even within the industrial sector, there are great wage differentials.

One could, for example, define a category of high wages associated with the industries considered dynamic and a category of low wages associated with the other industries. Thus, to the extent that the average ratio of high to low wages increases with the size of the city, inequalities tend to develop.

It was verified in section 4 that the average wage rate in Brazilian industry grows at an increasing rate with urban size; that is, the wage curve is convex. *Coeteris paribus,* analogous conclusions are arrived at as to high wages, using for this purpose the variable SD. The regression for SD as a function of urban population indicates that the elasticity of high wages in relation to urban size is around 1.43, which means that the wages paid by the dynamic industries contribute to widening income differentials

[56] More precisely, these migrants were receiving an income equal to or less than 200 *cruzeiros* per month, at a time that the highest minimum legal wage rate was 187.2 *cruzeiros* per month. It should be further noted that this percentage refers only to the employed urban migrants. See M. da Mata *et al.*, ch. 4, section 4.2.

as the city grows.[57] In fact, the average industrial wage is largely influenced by the behavior of hight wages. It should also be noted that the sign of DI and SD are both positive in the income distribution equation, and therefore contribute to increasing inequalities.

From the point of view of economic policy, perhaps it is more important to know the structure of demand than the level and distribution of family income.[58] It is implicit that certain family expenses vary according to the characteristics of the city. According to the theory of residential location, rents and expenditures on urban transportation increase with the size of the city. In fact, from Table 6 it can be observed that "Rent" and "Public Transportation" are among the items that increase most with urban size. In both cases, this is even more pronounced in large metropolitan areas. This, as seen in the previous section, partly explains the abrupt rise of the average wage rate in these areas.

[57] The share of the dynamic industries is defined for each city as follows:

$$SD = \frac{\text{wage bill of dynamic industries}}{\text{wage bill of manufacturing industries}}, \text{ or}$$

$SD = h \frac{W_D}{W}$, where $h$ is the ratio of employment in dynamic industries ($L_D$) ÷ employment in all industries (L); $W_D$ is the average wage rate in the dynamic industries, and W the average wage rate in all industries.

The equation for high wages can then be expressed as $SD = a N^b$, or $\frac{W_D}{W} = H N^b$, where $H = \frac{a}{h} =$ constant. The elasticity of the (relative) high wages with respect to the urban size will be

$$\frac{d (\log SD)}{d (\log N)} = \frac{D (\log W_D - \log W)}{d (\log N)} = b = 1.13$$

In fact, to establish $h$ as a constant is a very strong hypothesis, since $L_D = f (W_D)$ and $L = g (W)$, that is, $\frac{LD}{L} = h = G \frac{W_D}{W}$. Thus substituting in the equation of high wages will give $\frac{W_D}{W} G \frac{W_D}{W} = a N^b$

[58] In the income equation, the concept of net family income was used, defined as total income (salaries, wages, rents, etc.) minus income tax and social security contributions. The income-expenditure accounting relationship can be expressed as: net income + reduced assets (sale of real estate, vehicles, etc.) + increased liabilities (credit purchases, etc.) = current expenditures + increased assets (purchase of real estate, vehicles, etc.) + reduced liabilities (reduced bills of credit, etc.) + insurance + gifts and contributions + family savings.

In Table 6 the item "Health Care" reveals a U-shaped curve, while "Education" expenses appear quite irregular for the urban classes. These items do, however, have some similarity. In Brazil, the larger cities are usually better equipped with free education (public system) and health services (social welfare) than the smaller cities. In the small centers, for example, the consumers are often obliged to use private medical services, thus incurring considerably heavy expenditures. As the cities become progressively larger, the consumers can opt for the health services offered by the government, which, though not appearing in the family budget, signify an increase in real income. In the large metropolitan areas, health expenses again weigh heavily. Due to his relatively high income, the consumer in the large center begins to give greater preference to the quality of the services (generally private), consequently spending more on health.

Table 6

*Percentage Composition of Current Family Expenditures, 1961-1962-1963*

| Item | Urban Size (1 000 Inhabitants) | | | | | |
|---|---|---|---|---|---|---|
| | Less than 50 | 50 - 250 | 250 - 500 | 500 - 2 000 | 2 000 and over | |
| Rent | 6.2 | 5.1 | 4.4 | 5.7 | 8.3 | |
| Maintenance of Residence | 5.7 | 6.1 | 6.0 | 6.4 | 6.9 | |
| Food | 42.3 | 39.1 | 43.4 | 42.2 | 33.7 | |
| Clothing | 11.6 | 9.8 | 8.6 | 8.2 | 8.4 | |
| Health Care | 4.9 | 4.1 | 3.3 | 3.1 | 4.4 | |
| Recreation | 2.1 | 2.1 | 1.4 | 2.0 | 2.3 | |
| Education | 1.4 | 1.9 | 1.8 | 2.3 | 2.1 | |
| Public Transportation | .8 | 1.4 | 1.6 | 3.8 | 4.4 | |
| Other | 26.3 | 30.4 | 27.5 | 26.3 | 29.5 | |
| Total Current Expenditures | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | |

Source: Same as Table 5.

One of the principal attractions of large cities is the availability of recreation and amenities in general. Various of these specialized services operate on economies of scale and require markets having a minimum size which can be reached only in the large urban centers. In addition, the demand for recreation clearly reflects a change in the preferences of the consumers (especially those in the upper income or wage classes), and such preferences depend on the characteristics of the city. Nevertheless, and despite these arguments, Table 5 shows that in Brazilian cities the share of expenditures on "Recreation" is surprisingly stable among the urban size classes. This could mean that, in terms

of consumer preferences, what is important is not the quantity of services consumed, but the possibility of consuming them at any moment desired. On the other hand, certain amenities, such as the environment of a large city, do not necessarily involve additional expenses.

As would be expected, "Food" has the largest share in the family budget. Together with "Clothing" expenses, it shows a decreasing relative participation with urban size and a marketd reduction in the large metropolitan areas. Considering that average family income increases with urban size, the data of Table 6 can also be interpreted as "Engel's curves". That is, the variations in family expenses are associated with the variations in family income. As to food expenses, Engel's law establishes that the percentage of income (or of total expenditures) spent on food declines as income increases. However, in the present case, this interpretation is subject to some reservations. Commonly, the design of cross-section samples for studies of family budgets attempts to control the influence of other variables such as average age, size of family, type of city, region, and so forth, so as to isolate the effects of income on the various items of expense. Likewise, it is supposed that the prices of the products are held constant. Yet, since it is known that not only income but also prices tend to increase with the size of the city, the data in Table 6 simultaneously reflect an income-effect and a price-effect.[50] Moreover, in dealing with average percentages by classes of cities, other types of influence, such as the effect of the family size variable (economies of scale in consumption) may be important. Ideally, it would be desirable to construct separate statistics for each class of income and size of family (and perhaps for each region). In this way, each city could be characterized by its demand structure. Thus, an urban development policy designed to stimulate a given type of city, the intermediate cities for example, should aim at affecting the aspects of demand characteristic of those centers in order to create conditions favorable to their growth.

[50] The equation of demand for the good $i$ can be written as $X_{ir} = F(Y_r, P_{ir})$, where $X_{ir}$ is the quantity of good $i$ consumed in the urban center $r$, $Y_r$ is the average family income in $r$, and $P_{ir}$ is the price of good $i$ in $r$. It is further held that $Y_r = F(N_r)$ and $P_{ir} = g(N_r)$, where $N_r$ is the size of the center $r$. Introducing these last two relations into the demand equations will give the following expression for the elastity of the demand for good $i$ in relation to the urban size: $e_{xn} = e_{xp}\, e_{pn} + e_{xy}\, e_{yn}$, where $e_{xp}$, $e_{xy}$ are the respective price and income elasticities of good $i$, and $e_{pn}$, $e_{yn}$ :the respective effects of the urban size on the prices of $i$ and on the income level.

## 6 — SOCIAL AND ECONOMIC INFRASTRUCTURE

In this section the second element of the urban size model is introduced: costs. The well-known inefficiency of the large urban agglomerations is based on the argument that the cost of the urban infrastructure in these centers is so high that it outweighs the benefits of the agglomeration. Under these conditions, the returns on private and public investments would tend to be higher in the smaller centers. In the present case, it is supposed that all the infrastructure services are supplied by the public sector, while directly productive activities are included in the private sector. Moreover, it is appropriate to divide the urban infrastructure in two components: the economic infrastructure and the social infrastructure. The first, which has the support of directly productive activities as its main function, includes the services of transport, energy, water, housing, and so forth. The second, which is related to the formation of human capital and the welfare of the community, includes education, health and social security services. [60] The investment in social infrastructure is therefore a function of urban population, population density and income distribution, while the investment in economic infrastructure depends on the level of aggregate urban income, or on the level and structure of the industrial product of the city. [61]

In econometric terms, the long-term average cost of infrastructure services is a function of the quantity and quality of these services, of the prices of inputs, of the conditions under which these inputs are supplied, and of the technology used. However, the estimation of such functions presents conceptual and empirical difficulties that are nearly insurmountable. [62] One possible alternative would be to use technical engineering data. [63]

[60] See N. H. Hansen, "Unbalanced Growth and Regional Development," *Western Economic Journal* (Autumn 1965): 3-14, especially p. 5; *idem*, "The Structure and Determinants of Local Public Investment Expenditures," *Review of Economics and Statistics* 47 (May 1965): 150-62.

[61] From the point of view of economic policy, the causal relation is reversed; that is, the government aims at encouraging new investments in directly productive activities through increasing the stock of economic infrastructure.

[62] For a more complete discussion of these problems, see W. Z. Hirsch, "The Supply of Urban Public Services," in *Issues in Urban Economics*, ed. Perloff and Wingo, pp. 477-525.

[63] In one of the few studies of this type, it was found that, for the industrial producer, the costs of infrastructure vary little as the size of the city increases. See *Costs of Urban Infrastructure as Related to City Size in Developing Countries: India Case Study* (Palo Alto: Stanford Research Institute, 1968).

Nevertheless, the great majority of studies on urban infrastructure are limited to estimating expenditure functions per capita (or by unit of area), by type of service and size of city, assuming that per capita expenses behave in a manner similar to average costs. However, such a procedure is subject to important qualifications. The per capita expenditure functions commonly include factors on both the cost side (quantity of services, indexes of quality) and the demand side (family income), in addition to other elements that do not fit into either of these categories, such as private income and intergovernmental transfers. Consequently, an increase in per capita expenses can not be associated with an increase in costs alone. It is known, for example, that social infrastructure services have a high income elasticity, and that such an increase may therefore be the result of an income effect.

With the objective of studying the case of Brazil, Table 7 shows per capita expenses according to three types of infrastructure. "Transportation and Communications" and "Urban Services" correspond to the economic infrastructure, and among the most important services are: urban transport, sanitation, water and sewage, public lighting, streets, parks, squares, and so on. Under "Education and Health" are included items such as medical and hospital assistance and primary education,

Table 7

*Per Capita Expenditures on Economic and Social Infrastructure by Urban Size Class*

(Cr$ per Inhabitant, 1969)

| Urban Size Class (1 000 Inhabitants) | Transportation and Communications | Education and Health | Urban Services |
|---|---|---|---|
| 50 — 100 | 8.00 | 12.20 | 32.88 |
| | (.87) | (.67) | (.65) |
| 100 — 250 | 8.39 | 10.48 | 32.93 |
| | (1.15) | (.53) | (.65) |
| 250 — 500 | 4.30 | 15.58 | 35.79 |
| | (.42) | (1.20) | (.86) |
| 500 — 2 000 | 3.80 | 7.50 | 18.94 |
| | (.67) | (.56) | (.67) |
| 2 000 and over | 11.35 | 56.06 | 71.45 |
| | (.25) | (.22) | (.57) |

Source: Ministério da Fazenda.
Note: The numbers between parentheses are the coefficients of variation.

that is, social infrastructure services. As the data on on expenditures ws obtained from municipal balance sheets, it does not include state and federal expenditures. The per capita expenditures also reflect, in part, the earmarking of intergovernmental transfer funds.[64] Generally speaking, the per capita values for the smaller size classes tend to be underestimated, while those for the larger cities approximate the actual infrastructure expenditures on the three levels of government.[65]

In Brazil, "Transportation and Communications" services and "Urban Services" are typically municipal. In these two functions, the per capita expenses form a U-shaped curve which reaches its low point in the secondary metropolitan areas. In "Urban Services", the ratio between the highest and the lowest per capita values is approximately 4; in "Transportation and Communications", it is approximately 3.[66]

The expenditures on "Education and Health" demonstrate irregular behavior, possibly due to the earmarking of intergovernmental transfers, and to the participation of the state and federal governments in such programs. In this category, the highest per capita value is seven times greater than the average for the secondary metropolitan areas, owing in part to the depressive effect of the peripheries of the latter.

By and large, the coefficients of variation are much higher for per capita expenses than for productivity, wages and family income, which reflects not only the dissimilarity between the cities, but also differing criteria for the classification of expenses in the municipal balance sheets. Furthermore, it is interesting to

64 The infrastructure is also characterized by indivisibilities. In the government and general administration function, for example, economies of scale are observed until the size of approximately 100 thousand inhabitants; with regard to this, see Araujo *et al.*, pp. 160-61. In Brazil, four functions ("Transportation and Communications", "Urban Services", "Health and Education" and "Government Administration") include, on the average, 80% of the municipal expenditures.

65 In the smaller and relatively poorer cities, the participation of state and federal governments through direct investments tends to be important; this introduces a downward bias in the per capita values calculated for these cities. B the same reasoning, the values obtained for the larger cities approximate the totals expended on infrastructure.

66 It is interesting to observe that, even disaggregating the class of cities with less than 50 thousand inhabitants (e.g. Araujo *et al.*, Table V. 16), the minimum expenditures on "Transportation and Communications" continue to be in the class having 500-2 000 thousand inhabitants. In "Urban Services", however, all the classes of cities with less than 50 thousand inhabitants show per capita values lower than those for the large metropolitan areas.

point out the case of the large metropolitan areas, where the average values of per capita expenses conceal important differences between the peripheries of Rio and São Paulo, as is well shown by the average per capita expenditures for the period 1968-1971.

Table 8 clearly illustrates that the striking difference in expenditures is between the peripheries of the metropolitan areas. That of Greater Rio, [07] formed by commuter towns, pushes the average for the metropolitan area down. In contrast, the periphery of Greater São Paulo is composed of industrialized and rich

Table 8

*São Paulo (MASP) and Rio de Janeiro (MARJ) Metropolitan Areas: Expenditures on Economic and Social Infrastructure*

(1968-1971 Averages, at 1969 Prices [a])

| Metropolitan Area | Per Capita Expenditures in Cr$ | | | Expenditures on Urban Services Cr$ 1 000/km² |
|---|---|---|---|---|
| | Transportation and Communications | Education and Health | Urban Services | |
| MASP | 11.21 | 32.81 | 71.64 | 172.27 |
| Capital City | 15.28 | 24.59 | 72.59 | 287.92 |
| Other *Municipios* | 9.86 | 33.72 | 71.54 | 159.42 |
| | (.83) | (.81) | (.73) | (1.00) |
| MARJ | 6.70 | 20.94 | 19.38 | 64.17 |
| Capital City | 24.30 | 70.97 | 54.65 | 198.43 |
| Other *Municipios* | 3.36 | 5.92 | 13.49 | 41.80 |
| | (.95) | (.51) | (.44) | (.77) |

Source: Ministério da Fazenda.

a The current values for *MASP* were deflated using the cost-of-living index. For *MARJ* the public services price index was used.

No. The numbers between parentheses are the coefficients of variation.

*municípios* having tax revenues (excluding intergovernamental transfers) that exceed the per capita expenditures of the capital. Table 8 shows two additional average values for urban services: per capita and by unit of area. The second gives better evidence of the effects of the diseconomies of agglomeration, and shows that the differential between São Paulo and Rio de Janeiro is much greater when calculated by unit of area.

07 Note that, though the values have been corrected; there is still an upward bias in those for Rio de Janeiro due to its double function (as municipality and state) up to 1974.

Investments in infrastructure are often used by the government as an instrument to attract new private activities, or diretctly productive activities, to a given location. However, experience has proven that this policy does not always lead to satisfactory results. Once the infrastructure is established, the government adopts a passive positon, naturally expecting that private activities will come in great numbers to those locations which are well-equipped with basic services. Figure 3 illustrates the relationship between directly productive activities and economic and social infrastructure.

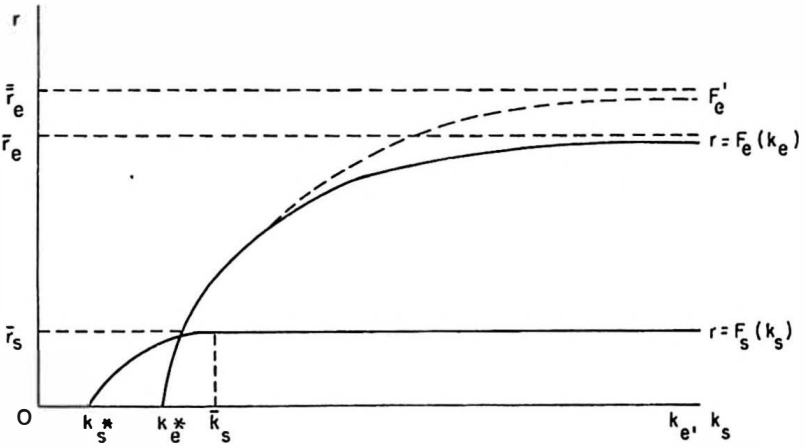


FIGURE 3 — EFFECT OF THE ECONOMIC AND SOCIAL INFRASTRUCTURE ON DIRECTLY PRODUCTIVE ACTIVITIES

The variable $r$, on the vertical axis, represents the value of private capital per unit of area (km², for example). When such data is not available, the rate of return on this capital can be used. On the horizontal axis, $k_e$ and $k_s$ measure, respectively, the value of the stock of economic and social infrastructure per unit of area. At the intersection of the curve $F_e$ with the axis of the abscissas, the value $k_e^*$ is the critical minimum level of the economic infrastructure, below which any directly productive activity becomes unfeasible. On the curve $F_s$, the point $k_s^*$ is interpreted analogously. Further, it is plausible to assume that $k_s^* \leq k_e^*$. The

curve $F_e$ asymptotically approaches the value $r_e$, which represents the saturation level for the economic infrastructure. [68]

Technological progress would have the effect of shifting the curve $F_e$ upward along the broken line $F'_e$, raising the saturation point from $\bar{r}_e$ to $\bar{\bar{r}}_e$. Thus, a policy emphasizing this type of infrastructure will be the more inefficient the closer the curve $F_e$ is to the saturation point; this, in part, explains the failure of various experiments with industrial districts and other basic service programs. Contrary to $F_e$, the curve $F_s$ becomes constant at the level $\bar{r}_s$ for any $k_s \geqslant \bar{k}_s$. It is also assumed that $\bar{r}_s \leq \bar{r}_e$

In short, an urban development policy that utilizes the economic infrastructure as an instrument will initially be a strong stimulus to new directly productive activities; yet, this effect should progressively lessen as the accumulation of capital increases. Within this same reasoning, the effects induced by the social infrastructure are far more limited. This type of service is actually much more related to the level of welfare of the community than to directly productive activities. [69]

## 7 — FINAL CONSIDERATIONS

According to this analysis of Brazilian urbanization, the indexes of average benefits — productivity, wages and family income — reveal an increase of between 50% and 100% from the smallest to the largest urban size class. On the other hand, the ratio between the highest and the lowest value for per capita expenditures ranges from 3 to 4 for the economic infrastructure and 7 for the social

[68] The function would have the form: $r = \bar{r}_e - \frac{A}{k_e}$, where A is a positive constant. $\bar{r}_e$ is the saturation point, and the critical minimum is defined as

$$k_e^* = \frac{A}{\bar{r}_e}.$$

[69] One would thus have a system of three equations and four unknowns:

$$r = F_e\ (k_e);\ k_s = f(d);\ d = g(r)$$

where the first is the equation for the economic infrastructure. In the second, the social infrastructure is a function of the needs of the community measured by the urban population, or, preferably, by the population density (d). Finally, the third relationship shows that the size of the city depends on the importance of the directly productive activities. Once a value has been chosen for $k_e$, the other variables can be calculated by introducing them into the equations for the system.

infrastructure. The benefit differential in Brazil is therefore comparable to those found in industrialized countries.[70] Nevertheless, in relation to costs, even after correcting the underestimation for the smaller cities, the differentials should be regarded as excessively large.

Generally, in the industrialized countries the increase in benefits with urban size surpasses the increases in costs. This led Alonso to argue that, if an optimal city size exists, it depends much more on the function of average productivity than on the function of average productivity than on the function of per capita costs.[71] In the case of Brazil, however, the empirical evidence of the preceding sections suggests a close association between the cost differential and the semiprimate structure of the urban system; this means that, in this case, the efficiency of a city depends on both the benefit and the cost curves. Unfortunately, there is not enough information available to characterize with any precision the degree of economic efficiency (or inefficiency) of Greater Rio and Greater São Paulo. However, the latter has been showing signs of diseconomies of agglomeration. This is suggested, for example, by the recent shift of large industries to cities near the capital.

The accelerated rise in urban infrastructure costs is not a phenomenon limited to underdeveloped countries. Baumol argues that the secular growth of these costs, and the consequent chronic deficit of the cities, is due to the low productivity of infrastructure services relative to the other sectors of the economy.[72] Despite recent technological progress, a large number of services, such as education, health, sanitation, police, and so forth, have shown modests gains in productivity compared to other sectors. Iet us then assume, as does Baumol, that the economy is divided in two sectors. In the first, the productivity of labor is increasing; in the

70 Specifically, in Germany, Japan and the United States. See Alonso, "The Economics of Urban Size," pp. 72-76; and K. Mera, "On the Urban Agglomeration and Economic Efficiency," *Economic Development and Cultural Change* 21 (January 1973): 312-13.

71 "Urban and Regional Imbalances in Economic Development," p. 4.

72 W. J. Baumol, "Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis," *American Economic Review* 57 (June 1967): 415-26.

73 According to the last Brazilian population census, slightly more than 89% of the persons engaged in "Social Activities" were in the cities. However, not all the services in this branch can be classified as infrastructural. Furthermore, in the census, the public utility industries are classified in the secondary sector. In 1970, a total of 1 458 thouand persons were employed in the following urban activities: production and distribution of electrical energy and gas; water supply, sewage services and other public works; public medical and hospital assistance; military police; civil police; fire department; and city administration.

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