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Export agriculture and the problem of food production *

Fernando B. Homem de Melo **

1 — Introduction

As traditionally defined, the agricultural sector of an economy has several functions during the economic development process, two of which are adequate food production and the obtention of foreign exchange. These two objectives have considerable significance within the framework of the current Brazilian situation. Since 1974, the difficult situation of the Brazilian balance of payments has caused pressure to be exerted on the agricultural sector for the production of an increasing exportable surplus. Furthermore, when the results of the 1970 census were released, the debate on the distributive aspects of development in Brazil gained force, impelled by the economic difficulties which arose in 1974. In addition, the validity of the development model which had been used until that time was brought into question. In this context, criticism was voiced against the excessive "opening" of the economy to the detriment of the internal market; it was believed that greater importance should be given to factors such as the availability and the relative prices of the food products of greatest importance to the lowest income strata of the population.

This scenario reflects the double pressure to which the Brazilian agricultural sector is currently subjected. While an increase in agricultural exports requires new resources, the food product price

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trend on the internal market has been used as an indicator of the distribution of real income. In the short-run, an improvement in the performance of food production should at least affect the performance of the agricultural export sector, in terms of production and quantity exported. [1] We do not pretend to propose definitive solutions for such a complex and politically sensitive problem. Our objective is more modest: we wish to make a contribution to the discussions on both agriculture in the current Brazilian context, and the use of economic policy instruments. For this purpose, this paper will be divided into two main parts. In the first, we shall characterize the agricultural exports within the context of the balance of payments. In the second part, we shall discuss the distributive implications of a possible adjustment of the agricultural sector to export stimulation policy measures.

2 — The crisis of the external sector and the 1974-1977 period

In 1974, the Brazilian balance of payments situation was drastically inverted. It was the year in which the complete impact of the oil crisis and the consequential deterioration of the terms of trade were first perceived. [2] A summary of Brazil's foreign accounts is presented in Table 1, in reference to which some points should be immediately

Table 1

Brazil: The Balance of Payments (in US$ Millions)

Accounts	1973	1974	1975	1976	1977
1. Commercial		—4 690	— 3 490	—2 151	140
1.1. Exports	6 199	7 051	8 670	10 126	12 130
1.2. Imports	—6 102	—12 641	—12 160	—12 277	—11 990
2. Services and Unrequited Transfers	—1 695	— 2 432	—3 213	—3 913	—4 425
3. Current Transactions (1 + 2)	—1 688	—7 122	—6 712	—6 064	—4 285
4. Capital	3 512	6 254	6 161	6 080	4 945
5. Net Errors and Omissions	355	—68	—300	128	—200
6. Surplus or Deficit	2 170	—036	—050	1 053	460

SOURCE: *Conjuntura Econômica* and Malan and Luz (1077).

1 In the study by Homem de Melo (1978), the Brazilian agricultural sector is divided into two subsectors: exports and internal market goods. This division is determined by the exposure or non-exposure to international economic variables. Another recent study by Mendonça de Barros and Graham (1978) uses the same division of the agricultural sector.

2 It is not meant to be said that the 1974 commercial deficit was entirely caused by the oil crisis. On the contrary, although the value of fuel imports quadrupled this import item constituted only one third of the total increase observed (Malan and Luz, 1977).

clarified: (a) in 1974, imports showed an increase of over 100% in comparison with 1973. This could be explained by the increase in the price of petroleum and the resulting increase in expenditures and considerable increases in the imports of capital goods and raw materials; (b) during this period, exports were always increasing while imports remained nearly constant, converging on a balance of payments equilibrium in 1977; (c) the fairly high magnitudes of the net result of the capital account, indicating an increase in the foreign debt, as one of the short-run adjustment mechanisms.

Five years have gone by since the first signs of crisis in the Brazilian foreign accounts were discerned (October, 1973). This perspective now allows us to conduct a more precise analysis of the export trend and the performance of agricultural exports. Such analysis are of interest to us, since positive results in the balance of payments for an extended period of time [3] would mean the solution to the economy's external problem. Furthermore, agricultural exports, which account for approximately two thirds of Brazilian total exports (in U.S. dollars) in principle should never be disregarded in the formulation of export policy.

Table 2

Brazil: Agricultural, Semi-Manufactured and Manufactured Exports — 1973-1977 [a] *(in US$ Millions)*

Type	1973	1974	1975	1976	1977
Agricultural [b]	3 697	4 006 (8,4)	4 103 (2,4)	5 135 (25,2)	6 054 (17,9)
Semi-Manufactured	476	917 (92,6)	849 (−7,4)	842 (−0,8)	1 044 (24,4)
Manufactured	1 465	2 263 (54,5)	2 586 (14,3)	2 776 (7,3)	3 845 (38,5)
Total	6 199	7 951 (28,3)	8 670 (8,9)	10 126 (17,0)	12 139 (19,9)

SOURCE: *Conjuntura Econômica*, various numbers.

[a] The numbers in parenthesis (under the export magnitudes) show the percentual variations in relation to the immediately preceding year.

[b] In order to obtain total agricultural exports, the only adjustment mad was the subtraction of the export of minerals from the export of basic products. The result slightly overestimates agricultural total.

3 See also Malan and Luz (1977).

Some basic points may be detected: (a) agricultural exports registered growth in all of the years during the period, although in a fairly irregular pattern; (b) the exports of manufactured goods also showed irregularities during the period, but with the sole exception of 1976, they showed rates of growth exceeding those of the agricultural products "in natura". The years of 1975 and 1976 were years of relatively poor performance for this group of products, and it should be kept in mind that their total export value is partially influenced by the performance of the manufactured products of agricultural origin. [4]

Upon analyzing the post-1974 Brazilian exports (principally agricultural products) some additional aspects are worth mentioning. First, although there may have been some alterations, [5] the basis of Brazilian trade and exchange policies remain the same. The mini-devaluation system is still in effect, along with a set of measures incentivating the exportation of manufactured goods, despite the intensified reactions of the various importing countries. Using the concept of effective devaluation, however, some authors pointed out that while in 1974 the devaluation of the cruzeiro against the currencies of several of Brazil's main trading partners was above the purchasing power parity rule, in 1975 and 1976, it was several points below the same parity. [6] This coincides with the relatively poor performance of Brazilian manufactured goods exports.

Second, with regard to the performance of agricultural exports in monetary terms, we should examine the behavior of the international prices of the main Brazilian products. The first half of the seventies' was characterized by large foreign price increases of primary goods, but Brazil continued to rapidly increase export proceeds even after 1974. Coffee in 1976 and 1977 is the most outstanding example of such an impact: exports equalled US$ 2,500 millions against US$ 934 millions in 1975. The average price of coffee exported in 1976 was 147% higher than in 1975, with an increase of only 3% in tons exported.

The movement of international prices for cocoa, coffee, sugar, soybeans, cotton, and corn which represent more than 80% of the

4 Orange juice, vegetable oils, instant coffee and processed meats are among the main products.

5 See Homem de Melo and Zockun (1977). The principal alteration concerned subsidized credit for manufactured exports.

6 See Lemgruber (1976) and Homem de Melo and Zockun (1977). It seems that this situation was reversed in 1977 and 1978 with the effective devaluation above parity.

value of agricultural exports of recent years [7] may be summarized as follows:

	Periods of High International Prices	Periods of Low International Prices
Sugar	1974	1975
Cocoa	1973—74 e 1976	1975
Coffee	1976—77	—
Cotton	1973 e 1975—76	1974 e 1977
Soy	1973—76	1977
Corn	1974—76	—

Two isolated cases may be presented as examples of the importance of international price increase periods for Brazil: the increase in the value of sugar exports in 1974 (even with a decline in the quantity exported) corresponded to 74% of the increase observed in the total export revenue. Coffee exports in 1976 were more outstanding still, since their value increase (also with a decline in the quantity exported) corresponded to 100% of the total increase. Furthermore, Malan and Luz (1977) indicate that the expansion of the quantity of agricultural exports since 1974 has basically been due to the export of soy products (beans, flour, oil).

On the other hand, agricultural exports diminished considerably in 1978, as a result of the crop failures in the South-Central region, which resulted principally in the reduction of soy production and exports. [8] Furthermore, the international price of coffee in October 1978 corresponded to 50% of the price charged from October through December of 1977. This comparison was made following the frost of August 1978 in Brazil. With these negative events, total Brazilian exports should not be very different from that of 1977. Further still, the international coffee price decrease is a clear indication of

[7] The least important of these products is corn, which has been irregularly exported over the years.

[8] In balance of payments terms, the effects of harvest reductions should be taken into account with regard to the import of agricultural products.

the temporary nature of a large part of the export revenue in 1976 and 1977. During those two years, Brazilian foreign export revenue received an unexpected addition of US$ 1,500 million per year.

At this point, we wish to make some final comments. First, there seems to be no doubt that in recent years, positive results were achieved, despite the relatively limited economic growth of developed countries. Second, with the exception of soy and its subproducts, agricultural exports have been influenced by the temporarily favorable prices of some important products, such as sugar, cocoa and coffee. Third, exchange and trade policies were not significantly altered in 1974; exchange policy continued to follow the purchasing power parity rule. These two events probably allowed exchange policy to be used, keeping in mind the conditions under which the internal market was supplied with food products a subject which will be discussed below.

3 — The distributive aspects of a possible adjustment

Despite the positive results obtained to date, both the temporary nature of the gains received in the exportation of some important products and the penalization of agriculture by the post-war[9] Brazilian trade policy, are reasons to justify the consideration of agricultural export stimulating measures. Such measures would aim not only to achieve a balance of payments equilibrium, but also to promote the development of the agricultural sector. These measures might include a more substantial devaluation of the cruzeiro and/or a direct tax exemption (credit) in foreign transactions with "in natura" products.[10]

Accepting the consequence of these measures (i.e. the altering of the relative prices between exportable agricultural products and the agricultural products usually destined to the internal market), the economic forecast would be the expansion of the exportable agricultural products. This might be accomplished through the utilization of resources from the domestic agricultural subsector, and, as mentioned above, would tend to have a negative effect on the domestic agricultural subsector's performance (production and prices). It would also tend to provoke unfavorable distributive consequences. Due to the seriousness of such results, we shall examine the behavior of some relative prices of the last ten years — in

[9] See, for example, Veiga (1975), Zockun *et alii* (1976) and Pastore (1977).
[10] Many have considered agriculture to be an important element of the solution of the external crisis. See Malan (1976), Homem de Melo and Zockun (1977) and Mendonça de Barros and Graham (1978).

particular those prices with greatest exposure in the international market.

Two important events related to the external sector of the Brazilian economy took place during the second half of the sixties': (a) the introduction of the foreign exchange mini-devaluation system (in 1968) and, (b) the beginning of a favorable period for terms of trade, even with regard to the behavior of international prices for agricultural products. The introduction of the mini-devaluation system benefited the agricultural export sector by reducing the risk involved in real remuneration, and the favorable terms of trade increased such real remuneration, at least for some products. Thus, the allocative consequences in agriculture would be similar to those described above for the introduction of agricultural export stimulation measures, i.e. the price increase of exportable products in relation to the prices on the internal market.

In Table 3, we shall trace the terms of trade trend for agriculture-industry in the period 1966-1975 (during most of this period, favorable terms of trade predominated). The first column presents these terms of trade only for products usually traded in the internal market, all of them being food products. The other two columns illustrate the same trend for products traded in the external market, divided into two categories. It may be observed that in 1969 a favorable terms of trade phase began for both export product groups; this phase was still in effect in 1975. On the other hand, the relative prices of internal market products began to increase in 1970 and only stabilized in 1975. It should also be kept in mind that most of the period considered in Table 3 corresponds to years of high economic growth and therefore greater growth in the demand for food products.[11] Thus, the price trend for food products on the internal market would be strongly affected by both the supply and demand for these products.

We wish to complement the information of Table 3 and to detect possible alterations occurring in the composition of Brazilian agricultural production. For this purpose, Table 4 presents the production rates of growth for 14 products, including both those traded on the international market and those traded domestically (rice, beans, potatoes, onions and tomatoes) for the entire sixties' and the ten-year period 1967-1976. The latter is the period of favorable international prices for some products where alterations in the composition of production would have to be observed.

11 It should be clarified that we are assuming that the prices for internal market products are affected by the external market, but that the reverse is not true, since the external demand for these products is highly elastic, at least for the external market group 1.

Table 3

Trend in the Terms of Trade for Agriculture-Industry 1966-75 (1948 = 100), Three-Year Moving Average [1]

Year	Internal Market[2]	Internal Market I[3]	Internal Market II[4]
1966	105,8	71,6	80,5
1967	107,1	68,6	74,8
1968	104,0	66,9	76,8
1969	98,3	67,4	81,2
1970	100,8	71,6	86,4
1971	103,1	76,7	93,5
1972	118,9	90,4	105,4
1973	130,6	98,0	114,9
1974	138,8	101,3	125,7
1075	137,9	102,2	147,2

SOURCE: Original data, Instituto de Economia Agrícola e *Conjuntura Econômica*.

1 Three-year moving average of the ratio between prices received by São Paulo farmers and the industrial product price index (Index 18 in *Conjuntura Econômica*).

2 Products: Potatoes, manioc, rice, beans, onions, eggs, pork and milk.

3 Products: cotton, soy, peanuts, castor beans and tea.

4 Products: the five products of group I, plus coffee, sugar cane, oranges and bananas.

The comparison of average annual growth rates in both periods shows a decline in 1967-1976 for food products such as rice, beans, manioc, potatoes and tomatoes. The growth rates of the first four are well below the population growth rate, with beans and manioc values close to — 2.0% per year. [12] Since total Brazilian production is a good indicator of the total availability for the consumption of these goods, and since the importation of these same products is relatively insignificant, the decline in *per capita* consumption of these food products is substantial.

The results obtained by Mendonça de Barros and Graham (1978) tend to confirm this deterioration in the more recent period. Working with the domestic supply of calories related to rice, beans, manioc, potatoes and wheat, these authors conclude that the

12 If we were to include these results in the year 1977, they would probably be somewhat more favorable.

domestic *per capita* availability of calories decreased between 10 and 20% since 1971. Nevertheless, it seems that the inclusion of wheat causes these results to underestimate the *per capita* decrease, since in this period domestic wheat production increased at very high rates, [13] since the import substitution plan for this product had a partial substitution in the origin of the consumed product. Furthermore, Mendonça de Barros and Graham (1978) indicate that the real cost per calorie nearly doubled since 1971 – a reasonable result given internal demand's low price elasticity. Real prices of important food products increase rapidly but in a very unstable path. [14] In some cases, this increase is outstanding, with a reversion appearing only in 1977.

Table 4

Brazilian Agricultural Production Growth Rates: 13 Products

1960-1969 and 1967-1976 [1]

Products	1960–1969	1967–1976
Rice	3,23[a]	2,47[a]
Beans	4,19[a]	—1,96[a]
Manioc	—6,07[a]	—1,86[a]
Potatoes	4,34[a]	1,34[b]
Onions	3,48[a]	4,77[a]
Tomatoes	8,23[a]	5,11[a]
Corn	4,75[a]	3,55[a]
Peanuts	7,74[a]	— 6,80[a]
Bananas	4,36[a]	— 2,39[b]
Soy	16,39[a]	35,03[a]
Coffee	— 6,94[a]	— 0,17[b]
Sugar Cane	3,63[a]	3,56[a]
Cotton	1,61[b]	—1,99[b]

SOURCE: Homem de Melo (1978).
1. Letter *a* indicates significance at the 5% level and *b* indicates non-significance. Coffee, 1960–1969 and 1967–1975.

At this point, we wish to introduce more specific information regarding the importance of the food component in the family

13 The rate of growth for the domestic production of wheat was 14% during the period, and is therefore well above the increase in internal demand.

14 Homem de Melo (1978) presents evidence of the greater instability of internal market product prices in relation to external market prices. This may be a trend to alter the composition of Brazilian agricultural production towards exportables, as a result of the lower price risk.

budget of different income classes. With the data in Table 5, the great relative importance of expenditure on food may be observed for the lowest income class in the sample (0-2 minimum wages). Note also the decrease in the weight of this component as we move towards higher income classes. The importance of the price trend for products included in the food component [15] thus becomes evident. Since the agricultural price trend was high in relation to industrial prices since 1969, in terms of the prices received by the farmers (as seen in Table 1), income distribution may be negatively affected, in terms of expenditure.

Table 5

Behavior of the Weights of the Components in the Cost of Living Index Among Income Classes [1]

Item	0—2	2—6	6—10	10—33
Food	51,4	43,5	36,3	26,6
Housing	23,1	22,7	20,7	20,5
Personal Expenses	11,2	13,6	16,4	18,9
Transportation	4,4	6,3	8,2	11,1
Clothing	4,1	6,4	8,6	8,7
Health	4,6	5,3	6,2	7,8
Education	1,2	2,2	3,6	6,4

SOURCE: Instituto de Pesquisas Econômicas — Cost of Living Index. Family Budget Research, 1971.

[a] The numbers indicating income class refer to multiples of the minimum wage. The proportions of families in each class are: 0-2: 8.7%; 2-6: 46.9%; 6-10: 20.6% and 10-33: 23.8%.

The agricultural price increase at the producer level in relation to the industrial prices is confirmed at the wholesale price level, concepts of total supply and domestic availability in *Conjuntura Econômica*. While both the wholesale and retail prices received by the farmers are probably determined more freely in the market, the latter seem to be much more strongly influenced by the government price control policy (as they were during the period 1969-1976). These prices were used in the calculation of the cost of living index,

[15] Williamson (1977) analyzed the relative price trend for "strategic" wage goods and the expenditure inequality for the United States of the last 80 years.

contributing to the underestimation of the upward pressure being exerted.

Obviously, we may only reach definitive conclusions on the distributive impact of these alterations on relative prices through expenditures for the period 1969-1976 with knowledge of the weights of various components of the cost of living index, such as those in Table 5 for São Paulo. Also necessary is the information regarding the behavior of the price indices of these different components and the growth observed in the income of the diverse classes. A preliminary examination of the price index trend for São Paulo, Rio de Janeiro and Curitiba (the latter two published in *Conjuntura Econômica*) indicates that the price trend for other components had compensatory effects in distributive terms, although the index of the food component increased more than the index for all the years of this period. An example is the price of housing (rent) and residential articles. Each year they were below the general index, relatively benefiting the lower income classes, assuming that the weights in Table 5 are valid for the other cities. The exact reverse occurred with the personal expenses component, the third most important item in São Paulo, relatively penalizing the highest income classes. In any event, we suggest that other research projects seek to detect the distributive effect of the price alterations which have occurred since 1969, the year marking the beginning of favorable international prices. Such a research endeavor would be worthwhile, given the importance of this occurrence in the contemporary situation.

Within the current Brazilian economic scenario, large devaluations and other export stimulation measures are being reconsidered. In this context, the prices of export products, including agricultural products, tend to increase in relation to the others, while in the agricultural sector, the prices of export products would increase in relation to the domestic market prices.[16] Through the substitution effect in production, the transfer of resources for food crops in the domestic market to the food crops in the external market was stimulated during the period 1969-1976, and this subsector subsequently expanded. In this sense, the study by Zockun (1977) is interesting, since it quantifies the substitution effect among products in the case of soy. Zockun concludes that the domestic market products were those which were displaced by the expansion of soy cultivation from 1970 to 1973. In the states of São Paulo, Paraná

[16] With the numbers is Table 3, it may be observed that, since 1968, the prices of the external market products (I and II) increased in relation to the domestic market prices, in a proportion of 15 to 20%.

and Rio Grande do Sul, the main crops substituted were corn, beans, wheat, manioc, cotton and rice, along with pasturage.

On the other hand, the expansion and consolidation of soy cultivation in South-Central Brazil, for example, was not caused only by a period of favorable international prices, but also by important technological advances made by institutes of agricultural research, since the nineteen-fifties'.[17] International prices were clearly important for the development of this crop in the early 1970's; however, technological progress and its medium-run effects on the composition of production indicate a need to examine the agricultural sector's adjustment to export stimulation measures, also from this point of view.

While recognizing the difficulty in obtaining information regarding technological progress among different types of cultivations, we will use the output rate of growth (product per hectare) for the period 1967-1976 as the indicator of the occurrence or non-occurrence of this event. The output per unit of area of the various cultivations is principally affected by land conditions, climate, technology, product and factor prices. We shall assume, however, that in terms of output rate of growth, technological development is one of the most important variables. Technological development, as is understood here, is basically that which results in the improvement of new varieties through genetic research. These new varieties generally have a higher capacity of response to fertilizers and require more careful cultivation techniques.[18]

Table 6 shows the output rates of growth for several cultivations in the South-Central region of Brazil, in all of Brazil, and in the States of Minas Gerais, São Paulo, Paraná, Rio Grande do Sul, Mato Grosso, and Goiás, these states doubtlessly being those most responsible for the cultivation of the selected crops. These indicators show a more favorable situation for the cultivation of soy, cotton, coffee, corn and potatoes and fairly unfavorable conditions for beans and manioc.[19] Observe that some crops not mentioned, such as sugar cane, wheat and oranges, profited from technological development in previous periods[20] and that they were reproduced

[17] See Fundação Cargill (1977) and Homem de Melo (1978). The main varieties became commercially available in the mid-1960's.

[18] These requirements may even imply the mechanization of several techniques. It is perhaps for this reason that biochemical techniques have penetrated agricultural activities to a greater extent than machines.

[19] See Homem de Melo (1978) for information on the agricultural research conducted on various products.

[20] See Pastore, Dias and Castro (1976).

Table 6

Output Rates of Growth per Area Unit: Brazil and States, 12 Products, 1967/76

	Brasil	SP	PR	RGS	MT	GO	MG
Rice	—0,30[b]	—0,79[b]	5,50[a]	0,94[a]	—	—3,14[b]	—0,04[b]
Beans	—3,72[a]	—1,78[b]	—1,71[b]	—1,22[b]	—	—7,56[a]	—1,30[b]
Manioc	—2,44[a]	—0,25[b]	—	—0,07[b]	—	—	—1,24[a]
Potatoes	3,63[a]	5,69[a]	2,62[b]	3,06[a]	—	—	3,02[a]
Corn	1,05[a]	2,21[a]	—3,07[b]	1,84[a]	2,44[a]	2,42[a]	0,17[b]
Peanuts	1,17[b]	2,55[a]	—1,19[b]	—	—1,60[b]	—	—
Sugar-cane	0,70[a]	0,98[b]	—	—	—	—	—0,96[b]
Coffee[1]	3,41[b]	7,55[a]	0,79[b]	—	—	—	5,21[b]
Cotton	—1,24[b]	2,68[a]	2,54[a]	—	—	7,42[a]	1,49[b]
Soy, Oranges, Wheat	0,16[a]	4,78[a]	6,52[a]	5,52[a]	1,83[b]	—	—
	—0,01[b]	0,63[b]	—	—	—	—	—0,56[b]
	—0,33[b]	2,80[b]	—0,53[b]	0,27[b]	—	—	—

SOURCE: Primary data, Fundação Instituto Brasileiro de Geografia e Estatística.
[1] For coffee, 1966—1975.

in greater rates of growth, in the part despite the signs of stagnation observed during this more recent period. Rice and peanuts also seem to have stagnant output.

Were we to accept the hypothesis that previously developed technology may still have effects on agricultural production in the present, for other regions and producers, agricultural exports stimulation measures through the manipulation of the exchange rates or tax exemption would probably have greater expansive effects on soy, cotton, corn, coffee, sugar cane, wheat and oranges, although the degree of heterogeneity of this effect among these products must be fairly high. Soy is apparently still the product with the greatest short-run potential, as is observed in examining its recent productivity improvement pattern. Nevertheless, the additional expansion of this product should not occur with the same ease as during the last ten years, because the main technological impulse had already taken place during said period. The more fertile areas were already occupied, making the total use of this technology in regions with different ecological conditions somewhat doubtful.

With regard to the other products, adjustments are needed in the specific coffee and sugar cane expansion policies, due to Brazil's prominent position in the international markets. Corn seems to have medium-run potential, as shown by several states' high output during the period 1967-1976. Cotton and oranges have available technology and should have easier expansion potential (oranges to be exported mainly processed).

Nevertheless, in terms of domestic market products (rice, beans, and manioc, among those included in Table 6) the possible consequences are fairly serious for two reasons. First, a large change in the foreign exchange policy or in the fiscal regime tends to affect a set of products, by altering relative prices. This would be unlike the period of favorable international prices which began in 1969 during which several, although not all, products were favored — most of them, however, only temporarily. Second, the exportable products showed technological development although in an uneven manner and occurring at different points in time. By contrast, the domestic market food products, with the exception of potatoes, show no evidence of productivity increases, and until the mid-seventies' few technological improvements have taken place.

These two facts lead us to foresee a fairly unfavorable situation with regard to production and price level for domestic market food products as a result of greater stimulation of agricultural exports.[21] For a correct evaluation of this negative impact, we would have to keep in mind that this occurs precisely following a period of clear deterioration in Brazilian production and consumption of food products, as illustrated in Table 4. It must also be observed that, for some of these food products, imported supplies are not very promising. Should the above-mentioned indications be correct, measures stimulating agricultural exports (aiming to solve the balance of payments problem) and their possible consequences should be analyzed with extreme caution. The Brazilian agricultural sector is apparently divided into two subsectors: exportable products and food products destined to the domestic market. The former presents technological conditions much more favorable than those of the latter, creating a situation which is extremely difficult to correct in the relative short-run.

4 — Some options and final considerations

Due to the two-fold pressure to which it is subjected, the Brazilian agricultural sector has faced a conflict in recent years in the formulation of economic policy. This two-fold pressure emerges, on the one hand, from the balance of payments disequilibrium, which

[21] Concerning the demand for agricultural labor, the results are not clear. Paula Pinto and Mendonça de Barros (1978) foresee a positive impact, using a model in which only labor is mobile among cultivations. Nevertheless, this is not necessarily valid, given the more realistic presence of other mobile factors and different production functions. Data from the Instituto de Economia Agrícola show that, with the exception of coffee and cotton, the use of labor per hectare is greater in the domestic market cultivations.

began in 1974, and which created the need to increase exports, including agricultural products. On the other hand, supply of food products to the domestic market is inadequate, principally due to the price trend, its distributive consequences and the resulting low nutrition levels. The unfavorable trend of the Brazilian production of some highly important food products (which serve as calorie and protein sources for low income families) probably explains why foreign exchange policy was not put to more radical use as a solution to the balance of payments problem.

Two factors should be stressed upon examining the alternative of providing greater *stimuli* to the agricultural products exports. First, a fairly ample set of products would be favored in the short-run, through changes in relative prices, in contrast with the period of favorable international prices which began in 1969. Second, a considerable disequilibrium may be observed among crops in the technological progress of Brazilian agriculture, creating a much less favorable situation for food products on the domestic market. This near total absence of productivity improvements in food production should be kept in mind in the formulation of economic policy, even when attempting to identify a short-run solution to the food problem.

Our discussion has been based upon an alternative for the balance of payments question, such as export *stimuli* for agricultural products. Instruments used for this purpose may include exchange and trade policy adjustments and have been considered due to the seriousness of the external sector crisis and the historical importance of the agricultural sector in total Brazilian exports. Pastore (1977) analyzes an alternative of this nature, in terms of longer-run agricultural development, due to the penalization which occurs due to import substitution policy. Malan and Luz (1977) argue for the need to not only decrease the consumption of international goods, but also to increase the domestic production of these goods, "rather than simply waiting for the eventual response of the private sector to the relative price signals, given the precariousness of the problem." With regard to the increase of production of exportable products, the responsibility should fall on the agricultural sector. Fonseca (1978) proposes to foster sectors which are less demanding in imports and relatively labor-intensive. These sectors would be the producers of those goods of popular consumption which are usually traded on the domestic market, such as the food products.

Upon analyzing the dual problem of the trade balance (agriculture and inflation), Sayad (1978) argues that "a devaluation policy aiming towards a reduction in the economy's liquidity, would

have very serious effects on the food supply for the urban sector and should therefore not be adopted. We conclude that exchange rates should be adjusted according to inflation, while the industrial sector's level of activity should be controlled, observing the foreign account situation." While this should be applied in the short-run, Sayad (1978) argues that in the long-run the solution to the problems of inflation and the balance of payments will depend on a realignment between the agricultural and industrial sectors, growth rates or a redistribution of income in the urban sector.

We have rapidly reviewed the positions taken with regard to the external sector problem, in an attempt to verify that, even after five years, Brazilian economists have yet to reach a consensus. However, upon concluding this study, we shall reconsider some measures worth a more detailed analysis, which could lead to a nutritional and distributive improvement. These measures would act principally through demand or by altering the quantity of food demanded on the market and take into account the restrition of the absence of significant technological advances in food production which is important in the short-run. Measures of this type have been utilized over time in several countries, including Brazil, in the case of several food products. Without running the risk of exhausting the alternative possibilities, we shall cite the following variants:

(a) Subsidies for specific food products, but applied to all consumers.

(b) Subsidies for specific food products, but applicable only to consumers with lower income levels.

(c) Different administrative prices for producers and consumers.

(d) Programs of direct monetary income transfer to part of the population, including programs relating the transfer to the consumption of food products.

Although some programs of this nature already exist in Brazil (the case of wheat and its products is a good example of alternative *c*) a retrospective examination of Brazilian economic policy shows a much greater use of measures oriented towards production and the marketing of agricultural products. [22] The results are not always adequate. [23] We do not wish to make it appear that the only important measures are those mentioned above; on the contrary, the solution to the food problem in Brazil will require the introduction of other instruments and the improvement of those already in use.

[22] See Homem de Melo (1978).

[23] Sayad's study (1977) on subsidized rural credit is a good example.

Nevertheless, several of these instruments need to operate for a long time to reach satisfactory results. [24]

Alternative *a* to *d*, listed above, affect the agricultural product market by altering the prices of specific food products or by altering the income of some consumers. The population groups included are the target of a previous decision, as are the products to be included and the magnitudes of the price changes and the transfers. [25] It is clear that, in order to reach decisions on policy information and difficult estimate need to be obtained. In Brazil, however, this has not impeded the implementation of certain programs such as those described above. The most common example is the alternative of fixed prices for producers and consumers; in some cases, this involves large subsidies such as those related to the programs for sugar and wheat, important sources of nutrition for lower income families. [26]

These two products, however, have important characteristics in comparison with other food products, particularly the geographic concentration of production and the need for industrial processing involving a relatively small number of firms. In the case of some food products, such as beans, rice, and manioc, the lack of such characteristics probably hinders the implementation of similar programs, which basically seek to subsidize the consumer price without penalizing the agricultural producer.

The administrative viability of programs of this type (alternatives *a* — *d*, as mentioned above) is an important factor to be considered *ex ante;* there is the risk of the policy's credibility being negatively affected if errors are committed or if difficulties arise following its implementation. In this respect, programs which seek to isolate part of the consumer population as a beneficiary, should be more complex from the administrative point of view. [27]

[24] Among these results, we would discard the generation of technology for the production of some food products and the occupation of the agricultural frontier. It should be emphasized that some instruments may be implemented more rapidly, such as regulating stocks for greater price stability.

[25] Studies on the economics of nutrition have made significant advances in recent years in Brazil. For a review of some of these studies and the presentation of evidence for the city of São Paulo, see Alves and Vieira (1978). These authors detect greater caloric than protein insufficiencies in poor familier as well as the importance of real income to explain the nutritional deterioration over time.

[26] Data presented by Alves and Vieira (1978) attest that sugar and bread constitute 31.6% of the total of calories per day and 23.5% (bread) of the protein total of families with an income of one minimum wage or less, in the city of São Paulo in 1971.

[27] Direct income transfer programs, including those related to food consumption, are more favorable in this respect. The recent study by Anderson and Calcedo (1978), shows that the alterations in the income distribution cause an improvement in the nutrition levels, even when supply is considered to be constant.

On the other hand, the alternative of subsidizing specific and generalized food products for all of the consumer population through, for example, indirect tax exemption, seems to be administratively easier, but it involver higher costs for the government. This is due to the nutritional waste involved and the need for changes in the fiscal system, particularly in the state governments' tax revenue. [28]

These brief reflections reveal the need to examine the available alternative instruments, in accordance with certain criteria, such as costs for the government, administrative viability, adjustments in food production, the effects on prices paid by consumers and received by farmers, the need for more imports, as well as other instruments, including complementary measures. [29] The difficulties should not discourage all those involved, since important social returns may be obtained.

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[28] A proposal was recently made to decrease the agricultural credit subsidies and to use financial resources to abolich ICM in transactions on agricultural products.

[29] For example, domestic market food products show higher instability in the prices received than those of the foreign market. Thus, regulating stocks may be considered as a complementary measure. See Homem de Melo (1978).

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Income distribution and social mobility: the Brazilian experience *

Virgilio H. S. Gibbon **

1 — Introduction

During the second half of the sixties as growth of the Brazilian economy reached high rates in relation to the previous period, interest has turned towards studies on income distribution as an effort to determine to what extent economic development promotes social development.

Studies previously conducted in this area have always been marred by the unavailability of the information necessary to analyze income distribution from a dinamic perspective.

Traditional methodology with its static measurement of inequality only allows for a comparative analysis at two points in time when based on cross-section data. In such analysis, for example, the adjustment processes involved go unobserved.

Studies such as those by Langoni (1973), Morley (1975), Castello Branco (1977) and Gary Fields (1977) call our attention to the need to analyze the dynamic aspects of income distribution which are masked by the static measurements of inequality. This need is particularly evident since one of the most important consequences of economic development (social mobility) cannot be measured by conventional methodology only.

The objective of this study is to fill the lacuna existing in the studies on income distribution in Brazil.

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For this purpose, we utilized data taken from personal income tax statements, which allowed for a selection of samples over time of the same individuals, [1] by CPF number. Transcending the needs of our study of income distribution, we were thus also able to construct mobility matrices which provide a more precise idea of the movements of individuals among income classes. We were also able to distinguish the phenomenon of mobility from the absorption of new entries to the labor market.

In Section 2 of this study, we shall analyze the income distribution of 1970 and 1975 with two different samples. One of the samples encompasses all of the individuals with earnings above the income tax exemption limit in 1970 and 1975; in the other, only the same individuals are considered. In Section 3, we shall study the mobility among income classes by constructing matrices of transition probabilities and origin matrices for Brazil as a whole, as well as a disaggregated analysis at the regional level.

As will be seen further on in this study, the construction of a matrix of transition probabilities with income tax data creates a bias, since the positive mobility of the lower classes is overestimated. In Section 4, we develop a methodology which allows us to estimate an expanded matrix of transition probabilities revealing the negative mobility of the lower income groups.

The origin matrices, also by virtue of the data utilized, create a bias as well, since they underestimate the probabilities of lower class origins. In Section 5, we shall develop a methodology to overcome this problem which also allows us to distinguish the phenomena of mobility from the absorption of new entries to the labor market.

In the final section of this study, a summary of the results is presented as well as some final comments regarding the implications of these results in the debate on income distribution in Brazil.

2 — Income distribution in Brazil: 1970-1975

2.1 — Description of the data and definition of the income classes

The data utilized refer to the gross annual individual earnings obtained from personal income tax statements for the years 1970 and 1975.

[1] For methodological purposes, it was unnecessary to identify the individuals. The CPF registration was utilized only as a key in the selection of samples and in the mounting of matrices, as will be observed further on in this study.

Since a change had been made in the income-tax exemption levels, our first concern was to define the sample for 1970 so that the inflated lower limit of the first class of that year corresponded to the base level of the first class of 1975, as stipulated by the legal exemption limit. [2] This was done so as to avoid comparisons of the samples based on different criteria.

We used the 1970-1975 cost of living index for the former State of Guanabara as the deflator (for that period, it indicated a variation of 159.66%). Thus, the low limit of the first class for 1970 was set at 10,000 cruzeiros [3] per year, which, when inflated, corresponded to 26,000 cruzeiros annually, i.e. the value corresponding to the 1975 exemption limit.

Since we proposed to study not only the income distribution of 1970 and 1975, but also the degree of mobility of individuals among the diverse income classes during this period, the income classes for those years were determined by two distinct equivalence concepts, levels of absolute and relative income. The first was obtained according to the determination of income classes for 1975, by merely inflating the class limits of 1970. The second, besides the inflation rate, also took into consideration the increase in *per capita* income during this period (48.178%). The difference between the class limits between 1970 and 1975, within this concept of equivalence is 284.8%.

In order to simplify the computation procedures, we used an instrument which allowed us to obtain the two equivalent concepts of income classes for 1975 simultaneously; this instrument was the use of the growth rate of the real *per capita* income observed during the period 1970-1975 as a determining factor of the range of the income classes.

The values obtained is this manner distinguished the income classes presented below and were numbered from 1 to 8 and from 1 to 9, for future simplification in the presentation of tables.

[2] The income tax exemption limits have evolved at rates which transcend the increases in the cost of living. For this reason, studies on income distribution which utilize data from the income statements must standardize the lower income limits in real terms. If this is not done, significant distortions in the frequencies of the lower classes will appear upon defining the equivalent income classes in the two periods. This would be the effect of a comparison of samples with different coverage. The exemption limit in 1970 was 5,040 cruzeiros, and in 1975, 26,000 cruzeiros. In other words, an increase of 415% against 159.7% in the cost of living index had taken place.

[3] The lower limit of our income classes in 1970 corresponds to 2.07 minimum wages of that year. In 1975, the lower limit corresponded to 3.75 minimum wages.

Chart 1

Income Classes

(In Cruzeiros)

Income Classes	1970	1975
1	10.012 ⊢ 14.836	26.000 ⊢ 38.523
2	14.836 ⊢ 21.984	38.523 ⊢ 57.083
3	21.984 ⊢ 32.575	57.083 ⊢ 84.584
4	32.575 ⊢ 48.269	84.584 ⊢ 125.335
5	48.269 ⊢ 71.524	125.335 ⊢ 185.719
6	71.524 ⊢ 105.983	185.719 ⊢ 275.195
7	105.983 ⊢ 157.043	275.195 ⊢ 407.777
8	157.043 ⊢	407.777 ⊢ 604.236*
9		604.236 ⊢

OBSERVATION: a) the rate of growth of the real *per capita* income in this period was 48.17% between 1970 and 1975; b) the variation rate of the cost of living index for the former State of Guanabara was 159.66% for the same period.

* This class is open, following the first equivalence concept previously described.

In this study, the universe of tax payers with income exceeding the tax exemption levels was used. For the year 1970, this sample encompasses 2,139,801 observations and, for the year 1975, 2,627,183 individuals.

We have also used a sample which comprises the intersection set of 1970 taxpayers who declared their income in 1975 as well. The sample's coverage was 1,467,969 observations in both periods; the sample was selected due to our interest in analyzing income distribution and social mobility of a single group of individuals over time.

As we have stated in previous studies, it appears that the greatest increase in inequality ocurred in the urban sector, as a result of the unbalanced development of the labor market. The choice of our sample was designed to analyze the income distribution and degree of mobility exactly in this sector, where the increase in income concentration was more pronounced.

2.2 — Empirical results

The income distribution results for 1970 and 1975 appear in Tables 1 and 2. These results were obtained by taking into consideration all of the individuals of the 1970 and 1975 samples who fell within

the limits set by the definition of equivalent income classes, incorporating the inflation rate and growth of *per capita* income in the period.

It is worth taking note of the considerable stability of distribution which was accompanied by only a small decrease in the relative frequencies in the two first and the two last income classes.

It was observed that 40.61% of the individuals fell within the first class in 1970 and 27.24% in the second. For 1975, these percentages were reduced to 39.72% and 26.62%, respectively. In the last class, there was a reduction of 0.38% to 0.35%, and in the penultimate class, 0.70% to 0.69%. The stability of distribution may still be observed in the aggregate statistics of inequality. The variance of the logs was 0.576 in 1970 and 0.585 in 1975, remaining essentially unaltered in the two periods.

These results contrast with those obtained in previous studies,[4] but since our sample is representative of the tail of a Pareto distribution, the results will require special interpretation. The assertion that income distribution remained unaltered should be understood as a reference to the stability of the distribution tail.

These results, however, provide little information regarding the appropriation of income by different strata of the population, since a lower frequency in the higher classes may be associated with a greater share of these classes in the total income.

In order to measure this effect, we transformed the frequency distributions into Lorenz curves, based on the observations of columns *a* and *b* of Tables 1 and 2. This was done by adjusting a parabola at each three points as was done for the calculation of moving averages. Therefore, in each parabola, we considered two observations which had already been utilized in the previous parabola, with an additional observation. Since the frequencies were very high in the first classes, they were cut in half, giving us 11 observations excluding point (0,0).

Table 3 explains the results obtained in these adjustments. As may be observed, there is perfect distribution stability, since the the variations perceived, both in the aggregate statistics of inequality and in the appropriations of income by the diverse deciles are insignificant. The lowest decile of the distribution, which in 1970 appropriated 4.76% of total income, saw its share reduced to 4.53% in 1975; the highest decile exceded 30.05% in 1970, reaching 30.67% in 1975.

In our sample, the poorest 30% of the population, who in 1970 received 14.53% of the income, had a share of 14.02% in 1975, while the wealthiest 30% increased their share from 44.92 to 45.34%.

[4] See Langoni (1973), Castello Branco (1977) and Morley (1975).

Table 1

Distribution and Composition of Income by Income Classes (All Individuals)

1970

Income Class	Frequency		Gross Earnings		Composition of Gross Earnings		Average of Gross Earnings (in cruzeiros)
	Relative (%)	Accumulated Relative (%) (A)	Relative Share (%)	Accumulated Relative Share (%) (B)	Labor Income (%)	Capital Income (%)	
1	40.61	40.61	20.94	20.94	86.37	9.32	12.100
2	27.24	67.85	20.72	41.66	86.47	10.28	17.866
3	15.84	83.69	17.83	59.49	86.37	11.77	26.435
4	8.96	92.65	14.93	74.42	85.88	13.02	39.118
5	4.40	97.05	10.78	85.20	83.28	15.96	57.531
6	1.87	98.92	6.76	91.96	78.98	20.31	84.968
7	0.70	99.62	3.77	95.73	72.64	26.68	125.521
8	0.38	100.00	4.25	99.98	61.41	37.64	262.673

SOURCE: Serpro/IRPF.

Average of Total Gross Earning: 23,480 cruzeiros (1970 cruzeiros).
Total Number of Individuals Observed: 2,130,801.
Variance of the log of Gross Earnings: 0,576.

Table 2

Distribution and Composition of Income by Income Classes (All Individuals)

1975

Income Class	Frequency		Gross Earnings		Composition of Gross Earnings		Average of Gross Earnings (in cruzeiros)
	Relative (%)	Accumulated Relative (%) (A)	Relative Share (%)	Accumulated Relative Share (%) (B)	Labor Income (%)	Capital Income (%)	
2	39.72	39.72	20.12	20.12	90.46	6.65	46.735
3	26.62	66.34	19.84	39.96	89.67	8.04	68.757
4	16.43	82.77	18.16	58.12	89.40	9.33	101.988
5	9.46	92.23	15.42	73.54	88.38	10.92	150.424
6	4.75	96.98	11.42	84.96	86.51	13.04	221.888
7	1.98	98.96	7.01	91.97	83.20	16.45	326.600
8	0.69	99.65	3.61	95.58	78.21	21.36	481.611
9	0.35	100.00	4.41	99.99	72.68	26.80	1.152.379

SOURCE: Serpro/IRPF.

Average of Total Gross Earnings: 92,251 (1975 cruzeiros).
Total Number of Individuals Observed: 2,627,183.
Variance of log of Gross Earnings: 0,585.

Table 3

Decile Distribution of Income
(All Individuals)

1970-1975

Population Percentage	Income Percentage				Accumulated Population Percentage
	1970	1975	Accumulated 1970	Accumulated 1975	
10—	4.76	4.53	4.76	4.53	10
10	4.77	4.53	9.53	9.06	20
10	5.00	4.96	14.53	14.02	30
10	5.27	5.95	19.80	19.97	40
10	6.93	6.19	26.73	26.16	50
10	8.39	8.81	35.12	34.97	60
10	8.86	8.87	43.98	43.84	70
10	11.10	10.82	55.08	54.66	80
10	14.87	14.67	69.95	69.33	90
10+	30.05	30.67	100.00	100.00	100

SOURCE: Tables 1 and 2, columns *a* and *b*.

1970		1975	
% of Population	% of Income	% of Population	% of Income
1+	7.17	1+	7.78
5+	19.97	5+	20.26
40—	19.80	40—	19.97
Gini...	0.33	Gini...	0.34

The measures of computed inequalities also show small variations (Gini: 0.33 in 1970, and 0.34 in 1975). Furthermore, the Lorenz curves cross in the fourth decile, which confirms the ambiguity of the interpretation regarding the trends of income distribution.[5]

[5] Besides the small increase, the magnitude of the Gini index is inferior to that found in previous studies. Langoni (1973), working with census data, found a Gini index for 1970 of 0.56. While working with income tax data, he found a Gini index of 0.48. His sample, however, had a lower bound level.

The increase in the share of labor income [6] in all income groups is very interesting. For all individuals of the seventh and eighth classes the labor income which represented 72.6 and 61.4% of their income, respectively, in 1970 increased to 78.2% and 72.7% in 1975. In a previous study, [7] income generated by physical capital is observed to be far more concentrated than that generated by human capital stock, but there is also evidence that a substantial share of total inequality results of the qualitative differences of the labor force.

Castello Branco (1977) provided ample empirical evidence regarding the effects of economic growth on the structure of the labor market disaggregated by sectors.

The increase in the share of labor income in total income, in the same period during which we observed relative stability in income distribution, merits a more detailed analysis.

Economic growth brings about a significant increase in employment opportunities for individuals with lesser qualifications, parallel to an upward shift in the demand for skilled labor. Therefore, while some individuals achieve upward income mobility due to the dynamic forces of development, (better job opportunities, working experience, returns to investments in education) a new and substantial labor contingent is incorporated in the labor force at the lower income groups.

These dynamic aspects of economic development suggest that the analysis of income distribution which compare two samples at different points in time require a careful interpretation of changes in the earnings profile, since various types of social phenomena are camouflaged by a set of aggregate measures of concentration. Therefore, in order to deliver a more precise interpretation of the redistributive effects of the development process we must differentiate the behavior of the earnings of the population sectors which were employed at both points in time covered by the analysis, from the earnings behavior of the new labor market entries which became effective during time period studied herein.

[6] Labor income is the sum of constant gross earnings of forms C and D in the income statements. All other categories were considered capital income. We considered the earnings of categories (earnings from agricultural and cattle-raising enterprise) as capital income. There surely exists some ambiguity in the classification of this type of earnings, nevertheless, we deem this classification to be correct, since capital income is usually underestimated in income statements.

[7] See Langoni (1973).

The lach of differentiation between these two contingents creates distortions, both quantitative and qualitative, since the recent labor market entries usually manifest diverse characteristics with regard to level of skill, age compostion, sex, etc.

Given the limitation of the sample used in this study it is not possible to analyze the entire income profile, and particularly the lower income groups where new less-skilled labor contingents are absorbed. Nevertheless, our data offer the opportunity to study the behavior of the income distribution of a sample formed by the same individuals in two points in time with considerable precision. Once each tax-payer possesses a CPF number, we may select the same individuals for the two periods. The income distribution results, considering only the same individuals, are presented in Tables 4, 5 and 6. The first outstanding result is the reduction of the relative frequencies of the two first low income groups and the increase in these frequencies for the others.

This frequency reduction is much more intense than that of the sample which takes all individuals into consideration. This brings to light a certain degree of mobility towards the higher income classes which was hidden in the total sample by the entry of new labor contingents in the tax-payer groups.

With regard to concentration, and using the Gini index and the variance of income logarithms as indicators, we observe a slight, though still insignificant concentration when only the same individuals are considered. The Gini index increased from 0.33 to 3.34 between 1970 and 1975, considering all individuals, and from 0.34 to 0.36, considering only the same. The variance of the logarithms increased from 0.57 to 0.58 for the distribution with all individuals and from 0.61 to 0.68 for the distribution with only the same individuals. The distribution by deciles did not present substantial modifications either. A decrease in the share of the two inferior deciles is observed as well as an increase of the share of the three superior deciles, although percentually insignificant.

As was to be expected, the increase in the gross average earnings of the distribution as a whole between 1970 and 1975 is significantly greater in the sample of the same individuals than in the sample of all individuals. (322.7 against 292.9%).

It is interesting to observe that, although we are working with a sample of tax-payers, the average rate of nominal income growth in the sample encompassing all individuals exceeded the growth of the *per capita* income in the period by only, 2,8% (292.9 to 284.8%).

Traditional literature on income distribution always encountered certain difficulties in interpreting variations in the indices of concentration in terms of social well-being, since such an interpretation

Table 4

Distribution and Composition of Income by Income Classes (Same Individuals)

1970

Income Class	Frequency		Gross Earnings		Composition of Gross Earnings		Gross Average Earnings (Cruzeiros)
	Relative (%)	Accumulated Relative (%) (A)	Relative Share (%)	Accumulated Relative Share (%) (B)	Labor Income (%)	Capital Income (%)	
1	30.52	30.52	14.27	14.27	89.39	7.75	12.325
2	29.20	59.72	19.92	34.19	88.67	9.19	17.988
3	19.29	79.01	19.40	53.59	87.55	11.02	26.496
4	11.41	90.42	16.95	70.54	86.58	12.51	30.158
5	5.72	96.14	12.48	83.02	83.79	15.56	57.563
6	2.44	98.58	7.86	90.88	79.37	20.01	84.044
7	0.91	99.49	4.35	95.23	72.99	26.47	125.504
8	0.49	99.98	4.76	99.99	61.20	37.95	256.846

SOURCE: Serpro/IRPF.

Average of Total Gross Earnings: 26,338 cruzeiros (at the 1970 value).
Total Number of Individuals Observed: 1,467,969.
Variance of log of Gross Earnings: 0.611.

Table 5

Distribution and Composition of Income by Income Groups (Same Individuals)

1975

Income Class	Frequency		Gross Earnings		Composition of Gross Earnings		Average Gross Earnings (in cruzeiros)
	Relative (%)	Accumulated Relative (%) (A)	Relative Share (%)	Accumulated Relative Share (%) (B)	Labor Income (%)	Capital Income (%)	
1	27.15	27.15	11.60	11.60	89.86	8.46	47.573
2	26.60	53.75	16.60	28.20	88.94	9.50	69.486
3	20.57	74.32	18.64	47.14	88.65	10.40	102.484
4	13.41	87.73	18.17	65.31	87.70	11.76	150.800
5	7.33	95.06	14.64	79.95	85.98	13.66	222.412
6	3.21	98.27	9.43	89.38	82.73	16.97	326.833
7	1.13	99.40	4.91	94.29	77.51	22.13	481.513
8	0.59	99.99	5.70	99.99	70.26	29.32	1.077.619

SOURCE: Serpro/IRPF.

Average of Total Gross Earnings: 111,336 Cruzeiros (at the 1975 value).
Total Number of Individuals Observed: 1,467,969.
Variance of log of Total Earnings: 0.675.

Table 6
Decile Income Distribution
(Same Individuals)
1970-1975

Percentage of the Population	Income Percentage				Accumulated Percentage of the Population
	1970	1975	Accumulated 1970	Accumulated 1975	
10—	4.29	3.82	4.29	3.82	10
10	4.39	4.11	8.68	7.93	20
10	4.72	5.02	13.40	12.95	30
10	6.16	5.16	19.56	18.11	40
10	7.01	6.76	26.57	24.87	50
10	8.18	8.79	34.75	33.66	60
10	9.60	9.22	44.35	42.88	70
10	10.66	10.98	55.01	53.86	80
10	15.17	15.56	70.18	69.42	90
10+	29.82	30.58	100.00	100.00	100

SOURCE: Tables 4 and 5, columns *a* and *b*.

1970		1975	
% Population	% Income	% Population	% Income
1+	7.21	1+	7.66
5+	19.63	5+	19.97
40—	19.56	40	18.11
Gini...	0.34	Gini...	0.36

requires the arbitrary definition of the function of well-being for society. [8] This difficulty looms larger still when such dynamic aspects as mobility and labor absorption are hidden behind modifications in the statistics of concentration.

Given the data presented in the previous section, it would be difficult to pass judgment on the manner in which the diverse social strata benefited from the economic growth process.

[8] See Aigner and Heins (1967).

In both the global model and that which considers only the same individuals, the relative stability of distribution does not clearly reveal the impact of the creation of new jobs, the possibility of upward social mobility of those already employed which are the phenomena which truly influence the future behavior of the appropriation of income. Therefore, the study of mobility among the diverse income classes with statistics especially developed for this purpose, is just as important, or more important still, to judge the social aspects of a development process, since only this type of information is capable of revealing the long-run trends deflagrated by the continual adjustments of the market forces in a dynamic context.

For this reason, in Section 3, we will develop an analysis of mobility based on the same samples which provided the aforementioned results so as to measure the probabilities of change in the income classes of the individuals already employed.

3 — Social mobility

3.1 — Methodological description

The data utilized, as we stated in Section 2, refer to the *gross annual earnings,* included in the income tax statements of individuals for the years 1970 and 1975.

Since our objective is to analyze the mobility of individuals among the diverse social classes, during the period under study, the income classes for 1970 and 1975 were determinded according to two distinct *equivalence* concepts.

The first of these concepts simply consists of inflating the limits of the 1970 classes so as to obtain the classes for 1975. Within this concept, the shift of an individual from class i in 1970 to class j in 1975 reflects a mobility which we shall term *absolute,* in order to reflect a mere variation of purchasing power in real terms. It becomes interesting, however, to create equivalent income classes which, besides inflation rate, also take into consideration the growth of real *per capita* income of the period. Therefore, if the difference between the 1970 and 1975 class limits incorporates, besides the inflation rate, the real growth of *per capita* income, the mobility of an individual of class i in 1970 to class j in 1975 would show that, besides an absolute improvement in terms of real purchasing power, this individual obtained gains superior to the average of the individuals. This would reflect a relative improvement. We shall call this *relative* mobility.

The terms absolute mobility and relative mobility may cause some semantic confusion, thus it is necessary to clarify the meanings

of these concepts, as they will be used throughout this study. With regard to absolute mobility, an increase in income exceeding the cost of living index for Rio de Janeiro, during the five years covered by the study, is required for an individual to ascend to a higher social class.

Therefore, mobility may be overestimated to the extent that the indices underestimate the inflation rate. The correct interpretation would be that, in order for the individual to attain a higher social class, his increase in income would have to exceed the variation in the cost of living index. Relative mobility, on the other hand, should be interpreted as the result of an increase in income superior to the cost of living index variation, plus the variation in the *per capita* income for the period. This *per capita* income, refers to national *per capita* income, rather than income estimated for the individuals of the sample.

Once the income classes were defined, we constructed a matrix of transition probabilities in which each element a_{ij} represents the percentage of individuals of class i in 1970 which shifted to class j in 1975, in the following manner:

$$M = \begin{bmatrix} a_{11} & a_{12} & \ldots\ldots\ldots\ldots & a_{18} \\ a_{21} & a_{22} & \ldots\ldots\ldots\ldots & a_{28} \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ a_{81} & a_{82} & \ldots\ldots\ldots\ldots & a_{88} \end{bmatrix}$$

The sum of the lines of this matrix is, by definition, equal to 1. The matrix would reflect perfect immobility if the values of the main diagonal were equal to 1 and the others equal to zero, or if $M = I$ (identity matrix).

Therefore, the higher the values of a_{ij} for $i \neq j$ and $j > i$, the greater the mobility in terms of income increases (positive mobility). Likewise, the higher the values a_{ij} for $i = j$ for $j < i$, the greater the mobility in terms of loss of income (negative mobility).

Since they are relative frequencies, elements a_{ij} may be interpreted in large samples as the probability of migration from class i to class j since as is known, relative frequency converges on the probability measure of the event as n increases.

It is interesting to note that, for the construction of such a matrix, it is necessary to obtain the data on income of the same individuals for the last two years under consideration, in order to locate

them in the various income classes. This was possible with the income tax data, since the fiscal identification number facilitated selection of the same individuals at the two points in time.

Since only the same individuals were considered at the two points in time, the matrix M, by definition, reflects the mobility of the labor contingent already employed in the labor market. In other words, it does not take into consideration the impact of the entry of new individuals.

We constructed two matrices of transition probabilities. The first, which we shall call the absolute matrix, considers the equivalent income classes in order to measure *absolute* mobility. The second matrix, called here the matrix of relative transition, considers the equivalent income classes to measure relative mobility. Table 1 specifies the important income classes for each matrix.

As may be observed in the definition of income classes, jumping one class according to the concept of relative mobility corresponds to jumping two classes according to the concept of absolute mobility.

3.2 – The matrix of transition: empirical results

Tables 7 and 8 illustrate the empirical results obtained from the matrixes of mobility.

As was previously explained, each element a_{ij} of the matrix of transition refers to the percentage of individuals who were in class i in 1970 and who migrated to class j in 1975. Thus, taking the matrix of absolute transition, we see that, of the individuals who were in the first income class in 1970, 27% remained in that same class in 1975 (element a_{11}), 38% migrated to Class 2 (element a_{12}), 22% migrated to Class 3 (element a_{13}), and so on. We are then able to observe that 73% of the individuals who belonged to the first low income class in 1970 moved on to higher classes. Of the individuals who composed the second class, 64% also received an increased real income. These percentages remained high, although declining, for all of the income classes. The shares of the third, fourth, fifth, sixth and seventh classes which migrated to higher classes were 62, 62, 58, 52 and 44% respectively.

In the matrix of relative transition, 48% of the individuals of the first class in 1970 shifted towards the higher income classes. This percentage is 33% for the second class, 33% for the third, 26% for the fourth, 21% for the fifth, 18% for the sixth and 15% for the seventh. Such mobility means that besides the increase in real income, the individuals who were able to enter the immediately superior income classes obtained gains exceeding the increase in real *per capita* income for the period.

Table 7

Matrix of Absolute Transition

Classes 1970	Classes 1975								$\sum_{i>1} a_{ij}$
	1	2	3	4	5	6	7	8	
1	0.27	0.38	0.22	0.00	0.03	0.01	—	—	0.73
2	0.00	0.27	0.34	0.21	0.07	0.02	—	—	0.64
3	0.04	0.10	0.24	0.34	0.21	0.06	0.01	—	0.62
4	0.02	0.04	0.00	0.23	0.36	0.20	0.05	0.01	0.62
5	0.01	0.03	0.05	0.11	0.23	0.35	0.18	0.05	0.58
6	0.01	0.02	0.03	0.05	0.11	0.26	0.34	0.18	0.52
7	0.01	0.01	0.02	0.04	0.07	0.14	0.26	0.44	0.44
8	0.01	0.01	0.02	0.02	0.05	0.08	0.13	0.68	0.00

SOURCE: Serpro/IRPF.

Table 8

Matrix of Relative Transition

Classes 1970	Classes 1970								$\sum_{i>j} a_{ij}$
	1	2	3	4	5	6	7	8	
1	0.52	0.31	0.12	0.04	0.01	—	—	—	0.48
2	0.20	0.28	0.23	0.08	0.02	—	—	—	0.33
3	0.10	0.25	0.35	0.21	0.06	0.06	—	—	0.33
4	0.04	0.00	0.24	0.36	0.20	0.05	0.01	—	0.26
5	0.03	0.05	0.11	0.23	0.36	0.18	0.04	0.01	0.21
6	0.02	0.03	0.05	0.11	0.26	0.34	0.14	0.04	0.18
7	0.01	0.02	0.04	0.07	0.14	0.27	0.29	0.15	0.15
8	0.01	0.02	0.02	0.05	0.08	0.13	0.21	0.48	0.00

SOURCE: Serpro/IRPF.

The methodology used in the construction of the matrix gave rise to certain biases in the results. Since we considered only the same individuals and equivalent income classes at two points in time the sample automatically excludes the individuals who were among the first classes in 1970 and who suffered a reduction in their income during the period t large enough to exclude them from the first class in 1975.

The matrix of transition probabilities as defined in this section, [9] and as estimated based in income tax data (with exemption limits)

[9] In reference to the use of matrices of the probability of transition in studies on mobility, see Szal, Richard T. and Robinson, Sherman (1974); Kemeny and Snell (1960).

contains a bias in that it overestimates the mobility of the lower income classes. In Section 4, we shall develop a methodology to overcome this difficulty.

3.3 — Matrix of origin: empirical results

Another way to visualize the existing degree of mobility is to analyze a transformation of the matrix of transition which we may call the matrix of origin. In this matrix, elements a_{ij} represent the percentages of individuals of the classes j in 1975, originating in the classes i in 1970. Therefore,

$$\sum_i a_{ij} = 1$$

This form of measuring the degree of mobility introduces a bias in the first income classes, since it does not take into consideration the individuals originating in the lower classes. Thus, the matrix of origin underestimates the positive mobility of the first classes. This difficulty is overcome with the use of a special methodology in Section 5.

Two matrices of origin were estimated. The first, which we shall call the matrix of *absolute* origin, and the second, the matrix of *relative* origin. The distinction between the two is bound to the concepts of equivalence utilized in the determination of income classes, as was previously observed. The results are presented in Tables 9 and 10.

Table 9

Matrix of Absolute Origin

Classes 1970	Classes 1975							
	1	2	3	4	5	6	7	8
1	0.74	0.50	0.35	0.18	0.09	0.04	0.02	0.01
2	0.19	0.31	0.41	0.32	0.17	0.08	0.04	0.02
3	0.05	0.07	0.18	0.33	0.31	0.17	0.08	0.04
4	0.01	0.02	0.04	0.13	0.31	0.31	0.18	0.08
5	—	0.01	0.01	0.03	0.10	0.28	0.32	0.16
6	—	—	—	0.01	0.02	0.09	0.26	0.26
7	—	—	—	—	—	0.02	0.08	0.24
8	—	—	—	—	—	0.01	0.02	0.20
Low Origin	0.00	0.50	0.76	0.81	0.88	0.88	0.90	0.80
High Origin	0.25	0.10	0.05	0.04	0.02	0.03	0.02	0.00

SOURCE: Serpro/IRPF.

Table 10

Matrix of Relative Origin

Classes 1970	Classes 1975							
	1	2	3	4	5	6	7	8
1	0.59	0.35	0.18	0.09	0.04	0.02	0.01	0.01
2	0.31	0.41	0.32	0.17	0.08	0.04	0.03	0.02
3	0.07	0.18	0.33	0.31	0.17	0.08	0.05	0.03
4	0.02	0.04	0.13	0.31	0.31	0.18	0.09	0.05
5	0.01	0.01	0.03	0.10	0.28	0.32	0.19	0.09
6	—	—	0.01	0.02	0.08	0.26	0.31	0.16
7	—	—	—	—	0.02	0.08	0.23	0.24
8	—	—	—	—	0.01	0.02	0.09	0.40
Low Origin	0.00	0.35	0.50	0.57	0.60	0.60	0.62	0.60
High Origin	0.41	0.23	0.17	0.12	0.11	0.10	0.09	0.00

SOURCE: Serpro/IRPF.

As may be observed, the percentage of individuals of the third class and beyond, having originated in the lower income classes, is particularly high. These percentages contrast drastically with these related to the origin of the higher classes which, with the exception of the first and second classes, in 1975 were less than 5% for the matrix of absolute origin.

In Table 9, of the elements which composed the eighth class in 1975, 1% came from class 1, 2% from class 2, 4% from class 3, 16% from class 5, 26% from class 6, 24% from class 7, and 20% from class 8. [10] For classes, 3, 4, 5, 6, and 7, the percentages of low origin are 76, 81, 88, 88 and 90% respectively.

In Table 10, these percentages are smaller, by virtue of the equivalence concept used in the definition of income classes. Nevertheless, they are considerably high for classes 5, 6 and 7 when they reach 60, 60 and 62% respectively.

The small percentages of low origin (i.e. the percentage of individuals having originated in the lower income classes) in the first classes are distorted by the fact that the absolute frequencies

[10] At first glance, these results appear to be inconsistent with those obtained with the matrix of transistion. If we had 0% migration from Class 1 in 1970 to Class 8 in 1975 in this matrix, how could 1% of Class 8 in 1975 have originated in Class 1 in 1970? This is merely a problem of rounding-off. 1% of the absolute frequency of Class 8 in 1975 is a small percentage of Class 1 in 1970. This percentage would be 0.04%, or zero, within the approximation which we are using.

of these classes in 1975 remained very low in the sample related to the construction of the matrices. We only considered those individuals who had declared earnings in 1970 and who also appeared in 1975. A large part of the absolute effective frequency in the first income classes in 1975 reflect the absorption of new individuals by the labor market during the period convered by the analysis, but unfortunately, they did not appear in the 1970 sample within the income limits considered by the class definitions.

The absorption phenomenon is another extremely important factor in the analysis of the effects of economic growth on income distribution, and has been neglected in studies previously conducted. In Section 5 of this study, we were able to measure this prenomenon, due to the use of the methodology developed, thus solving the distortion of the estimates of the percentages of origin from the first income classes.

4 — Mobility among income classes: the expanded matrix of transition probabilities

One of the deficiencies of the analysis of mobility developed in Section 3, is the fact that we do not possess information regarding the individuals of the lower classes of the sample who suffered a reduction in real income during the period covered by the analysis. Upon selecting two samples containing the same individuals at two points in time, distributed according to equivalent income classes, we automatically excluded those who were located in the first strata in 1970 and who shifted toward lower classes at the minimum limit considered in this study.

Considering the likely significance of the probability of such an occurence, particularly when dealing with individual data, in this chapter, we shall attempt to develop a methodology based on the information contained in the frequency distributions and in the matrices of transition probabilities and which will allow us to estimate the magnitude of the phenomenon.

For this purpose, we shall estimate a probabilities triangle, which, together with the matrix of the transition probabilities, overcomes its deficiency regarding the individuals who suffered reductions in real income during the period. Considering that migrations to up to four lower classes would be sufficient to encompass a significant percentage of the individuals with income reductions, our objective was to transform a matrix squared M_{8x8} in a trapezium as described in Chart 3.

In this trapezium, the element $b_{1\bar{3}}$ represents the percentage of individuals of class 1 in 1970 who migrated to class $\bar{3}$ in 1975, in

other words, those who migrated four classes downward during the period under analysis.

Likewise, the elements $b_{2\bar{2}}$, $b_{3\bar{1}}$ and b_{40} also reflect the loss of the four classes. The elements $b_{1\bar{2}}$, $b_{2\bar{1}}$ and b_{30} reflect the loss of three classes. The elements $b_{1\bar{1}}$, and b_{20} reflect the loss of the two classes, and b_{10} the loss of one class.

Since all of the lines of the trapezium should sum up to 1, the first four lines of the squared matrix underwent alterations (for this reason we use letter b). The others remained identical to those of the corresponding matrices of transition (for which reason we kept the letter a).

Thanks to the methodology utilized in the determination of the scope of the classes, in order to calculate classes 0, —1, —2, and —3 we needed only to divide the limits by 1,48178 (the rate of growth of the real *per capita* income plus 1) to obtain the immediately lower classes. Thus proceeding, we obtain the income classes presented below in Chart 2.

It is worth noting that the lower limit of class —3 in 1970 corresponds to a monthly income of 156.69 cruzeiros and 317.23 cruzeiros in 1975. During those years, the minimum wage was 187.20 cruzeiros and 532.80 cruzeiros respectively. However, our analysis of mobility in this chapter also includes a stratum of the population of very low purchasing power.

In the original tables, we have the absolute frequencies by income class in 1970 and 1975 for distributions which include all of the individuals at the two points in time, and then alternatively, for the same individuals. [11] Therefore, we may assume that the difference between the absolute frequencies by class refer to individuals who either *died* [12] during the period or migrated to lower classes. [13] Our first concern was to estimate a *proxy* for the mortality rate so as to subtract it from the total of individuals excluded in the sample relevant to the matrix, to obtain an estimate of the number of individuals who lost income.

The *proxy* was estimated as follows:

1. That an individual of the seventh and eighth income classes of 1970 could suffer a reduction in income large enough

11 See statistical annex.

12 The word *died* should be interpreted *lato sensu*. Besides death, other factors such as old age, marriage, and travel may cause an individual to cease to declare income. Our estimate of the *mortality rate* encompasses all of these factors.

13 In this case, this would mean falling below the exemption levels of 1975, due to the construction of the intervals of income classes. See item 2.2.

Chart 2

Income Classes	1970	1975
—3	2.076 |— 3.077	5.393 |— 7.991
—2	3.077 |— 4.560	7.992 |— 11.841
—1	4.560 |— 6.757	11.841 |— 17.546
0	6.757 |— 10.012	17.546 |— 26.000
1	10.012 |— 14.836	26.000 |— 38.523
2	14.836 |— 21.984	38.523 |— 57.083
3	21.984 |— 32.575	57.083 |— 84.584
4	32.575 |— 48.269	84.584 |— 125.335
5	48.269 |— 71.524	125.335 |— 185.719
6	71.524 |— 105.983	185.719 |— 275.195
7	105.983 |— 157.043	275.195 |— 407.777
8	157.043 |—	407.777 |— 604.236
9		604.236 |—

Chart 3

Mobility Trapezium

Income Classes 1970	Income Classes — 1975											
	$\bar{3}$	$\bar{2}$	$\bar{1}$	0	1	2	3	4	5	6	7	8
1	$b_{1\bar{3}}$	$b_{1\bar{2}}$	$b_{1\bar{1}}$	b_{10}	b_{11}	b_{12}	b_{13}	b_{14}	b_{15}	b_{16}	b_{17}	b_{18}
2		$b_{2\bar{2}}$	$b_{2\bar{1}}$	$b_{2\bar{0}}$	b_{21}	b_{22}	b_{23}	b_{24}	b_{25}	b_{26}	b_{27}	b_{28}
3			$b_{3\bar{1}}$	b_{30}	b_{31}	b_{32}	b_{33}	b_{34}	b_{35}	b_{36}	b_{37}	b_{38}
4				b_{40}	b_{41}	b_{42}	b_{43}	b_{44}	b_{45}	b_{46}	b_{47}	b_{48}
5					a_{51}	a_{52}	a_{53}	a_{54}	a_{55}	a_{56}	a_{57}	a_{58}
6					a_{61}	a_{62}	a_{63}	a_{64}	a_{65}	a_{66}	a_{67}	a_{68}
7					a_{71}	a_{72}	a_{73}	a_{74}	a_{75}	a_{76}	a_{77}	a_{78}
8					a_{81}	a_{82}	a_{83}	a_{84}	a_{85}	a_{86}	a_{87}	a_{88}

exclude him even from the first class of 1975, was considered to be a null probability. [11]

2. We added the absolute frequencies of the seventh and eighth income classes of 1970 to the sample containing all of the individuals.

3. We added the absolute frequencies of the seventh and eighth income classes of 1970 to the sample containing the same individuals.

4. We subtracted the total obtained in item 3 from the total obtained in item 2.

5. We divided the result obtained in item 4 by the total obtained in item 2 and we called this result m, which represents the mortality rate. In other words, calling

$\overset{70}{F}_{T_7}$ and $\overset{70}{F}_{T_8}$ the absolute frequencies of classes 7 and 8 of 1970 for the sample containing all of the individuals, and

$\overset{70}{F}_{M_7}$ and $\overset{70}{F}_{M_8}$ the absolute frequencies of classes 7 and 8 in 1970 for the sample containing the same individuals, we made the following calculations:

$$m = \frac{\left(\overset{70}{F}_{T_7} + \overset{70}{F}_{T_8}\right) - \left(\overset{70}{F}_{M_7} + \overset{70}{F}_{M_8}\right)}{\overset{70}{F}_{T_7} + \overset{70}{F}_{T_8}}$$

The utilization of the differences in frequency in classes 7 and 8 among the two samples as a mortality *proxy* merits some comments. First, since we are working with a sample representative of the tail of a Pareto distribution, or rather, with data that exclude the poorest stratum of the population, we do not expect the income variable to be crucial in the determination of the mortality rate as such. It thus seems plausible to use the same rate for both the higher and lower income classes in our sample.

Second, the analysis of the income/age profiles indicates that the highest incomes occur in an intermediate age group, observing a decline in earnings at more advanced ages. Thus, when taking the data of the highest income classes as an element of estimation of the mortality rate, we should not overestimate its value either.

[14] This hypothesis is consistent with the empirical results observed in Table 9.

Once having obtained the mortality rate, we applied a percentage found on the absolute frequencies of the first four income classes of 1970 in the sample containing all of the individuals who died in class i.

We have calculated below the differences of the absolute frequencies of the first four income classes in 1970 between the two samples, in other words, we calculated the differences $\overset{70}{F}_{T_i} - \overset{70}{F}_{M_i}$ for i varying from 1 to 4. We called these differences d_i. These differences give us the number of individuals by class who disappeared when we passed from the sample containing all of the individuals in 1970 to the sample containing the same individuals, also in 1970. [15]

If we subtract the values of M_i from d_i, in other words, if we subtract the number of individuals who *died* from the number of all the individuals who disappeared from the sample, we will obtain the number individuals who suffered a loss of income and who, for this reason, disappeared from the sample. This number, which we shall call TD_i (the total to be distributed in class i), was calculated for each income class and added to its absolute frequencies in the sample which contains the same individuals.

Based on this information, we altered the first four lines of the transition matrixes. Each element a_{ij} of the matrix represented the percentage of individuals in class i in 1970 who migrated to class j in 1975.

This percentage, however, referred to the absolute frequency of class i in the sample which contained the same individuals in 1970. In other words, if there were 100 individuals in the first class of 1970, one element a_{13} equal to 0.30 meant that 30% of the individuals who were in class 1 in 1970 moved on to class 3 in 1975. Therefore, the frequency of the first class increased by TD_1 individuals. In our example, therefore, 30% of the 100 corresponds to a smaller percentage of $100 + TD_1$. By simple arithmetics we altered the a_{ij} values of the first four lines of the transition matrices, to render these values consistent with the new absolute frequencies in effect for the respective classes.

The sum of the new b_{ij} for each line of the matrix was less than 1, since the percentages decreased. The difference between the unity and the summation of b_{ij} for each line i, and for j varying from 1 to 8 gave us the percentage of individuals of class i who lost income, and who therefore moved into lower classes.

[15] When we refer to the sample for 1970 which contains the "same individuals" we are referring to the sample consequential to the transition matrixes presented in Section 3. Actually, it is an intersection set of the samples of 1970 and 1975, which takes into consideration the individuals appearing in both.

In algebraic terms, the operations carried out were as follows:

a) $M_i = m. \overset{70}{\underset{T_i}{F}}$

where

M_i = the number of individuals who *died* in class i

m = the mortality rate, as previously defined

$\overset{70}{\underset{T_i}{F}}$ = absolute frequency of class i in 1970 for the sample which contains all of the individuals

b) $d_i = \overset{70}{\underset{T_i}{F}} - \overset{70}{\underset{M_i}{F}}$ for i varying from 1 to 4.

where

d_i = the number of individuals who disappeared by income class i, upon moving from the sample containing all of the individuals to that which contains only the same individuals.

F = absolute frequency of class i in 1970 for the sample containing all of the individuals

F = absolute frequency of class i in 1970 of the sample containing the same individuals.

c) $TD_i = d_i - M_i$

where

TD_i = the number of individuals to be added the absolute frequencies of the i classes in 1970 in the sample containing the same individuals.

d) $b_{ij} = \dfrac{a_{ij} \overset{70}{\underset{M_i}{F}}}{\overset{70}{\underset{M_i}{F}} + TD_i}$ for i varying from 1 to 4 and j varying from 1 to 8.

where

a_{ij} = the element of the transition matrix as presented in Section 3

b_{ij} = the new element of the transition matrix

e) $PD_i = 1 - \overset{8}{\underset{j=1}{\Sigma}} b_{ij}$, for each i

PD_i = the total percentage of the negative mobility to be distributed among the lower income classes.

Once we obtained the percentages (PD_i) to be distributed among the lower classes, we must still determine which percentage lost one, two, three or four classes, in other words, we must estimate the b_{ij} values for each i and for j varying from 0 to —3, so that

$$\sum_{j=-3}^{0} b_{ij} = PD_i.$$

For this purpose, we must estimate the probability of a loss of one, two, three and four income classes. Fortunately, the matrices of transition probabilities in Section 3 gave us the estimate.

The a_{ij} elements for $j = i\text{-}1$ give us the probability of loss of one class.

The a_{ij} elements for $j = i\text{-}2$ give us the probability of a loss of two classes, and henceforth, until reaching a loss of four classes. Therefore, the diagonal elements immediately inferior to the main diagonal are probabilities of regression of one class for classes 2 to 8.

If we take the four diagonals successively than the main diagonal, we will have in each one, the probabilities of a loss of one, two, three and four classes.

Calculating the average of the elements which compose these diagonals, we will obtain estimates of probabilities for one, two three and four losses which we shall call $P_K, K = 1,4$.

The first line of the triangle which we *add* to the matrix was calculated by the equation:

$$b_{1,1-K} = \frac{P_K \cdot PD_1}{\sum_{K=1}^{4} P_K},$$

for K varying from 1 to 4.

Thus, when K takes on the value 1, we obtain b_{10}; when K takes on value 2, we obtain $b_{1\bar{1}}$; when K takes on value 3, we obtain $b_{1\bar{2}}$; when K takes on value 4, we obtain $b_{1\bar{3}}$.

The second line of the triangle was calculated by the equation:

$$b_{2>2-K} = \frac{P_K \cdot PD_2}{\sum_{K=2}^{4} P_K}$$

for K varying from 2 to 4.

Thus, when K takes on the value 2, we obtain b_{20}; when K takes on value 3 we obtain $b_{2\bar{1}}$ and when K takes on value 4, we obtain $b_{2\bar{2}}$.

The third line of the triangle was calculated by following equation:

$$b_{3,3-K} = \frac{P_K \cdot PD_2}{\sum_{K=3}^{4} P_K}$$

for K varying from 3 to 4.

Thus, when K takes on value 3, we obtain b_{30} and when K takes on value 4 we obtain b_{31}.

The element b_{40} of the fourth line of the triangle is obviously:

$$b_{40} = 1 - \sum_{j=1}^{8} b_{4j}.$$

The expanded matrix of absolute transition with the respective estimated triangle appears in Table 11.

Based on the expanded matrix of absolute mobility, we developed six statistics which we shall define as follows:

1. Positive mobility $= \sum_{j} b_{ij}$ for $j > i$
2. Negative mobility $= \sum_{j} b_{ij}$ for $j < i$
3. Positive Average Jump
   $PAJ = (\sum_{j>i} b_{ij} [j - i]) \div \sum_{j>i} b_{ij}$
4. Negative Average Jump
   $NAJ = (\sum_{j<i} b_{ij} [j - i]) \div \sum_{j<i} b_{ij}$
5. Expected Jump
   $EJ = \sum_{j} b_{ij} (j - i)$
6. Null Mobility
   $NLM = b_{ij}$ for $i = j$

Table 12 illustrates these results by income classes.

Based on the methodology previously described, but working with the relative transition matrix, we obtained the expanded matrix of relative transition which appears in Table 13.

This matrix provided raw material for the computation of the statistics already defined and summarized in Table 14.

Table 11

Expanded Matrix of Absolute Mobility

Income Classes 1970	Negative Mobility	Income Classes — 1975												Positive Mobility
		3	2	1	0	1	2	3	4	5	6	7	8	
1	0.21	0.017	0.033	0.054	0.107	0.213	0.300	0.174	0.071	0.024	0.008			0.68
2	0.18		0.016	0.031	0.050	0.081	0.244	0.308	0.100	0.063	0.018			0.59
3	0.17			0.012	0.021	0.030	0.007	0.232	0.320	0.203	0.058	0.010		0.60
4	0.15				0.005	0.020	0.010	0.080	0.220	0.358	0.109	0.050	0.010	0.62
5	0.20					0.01	0.03	0.05	0.11	0.23	0.35	0.18	0.05	0.58
6	0.22					0.01	0.02	0.03	0.05	0.11	0.26	0.34	0.18	0.52
7	0.29					0.01	0.01	0.02	0.04	0.07	0.14	0.26	0.44	0.44
8	0.32					0.01	0.01	0.02	0.02	0.05	0.08	0.13	0.68	

Table 12

Statistics of Absolute Mobility

Summary of the Statistics Computed Based on Table 11

Income Classes	NLM	PM	NM	PAJ	NAJ	EJ
1	0.21	0.58	0.21	0.73	—1.81	0.62
2	0.24	0.59	0.18	0.64	—1.90	0.61
3	0.23	0.60	0.17	0.58	—1.69	0.66
4	0.23	0.62	0.15	1.53	—1.62	0.69
5	0.23	0.58	0.20	1.48	—1.70	0.52
6	0.26	0.52	0.22	1.35	—1.96	0.27
7	0.26	0.44	0.29	1.00	—2.03	—0.15
8	0.68		0.32		—2.34	—0.75

Note that, even after the statistical adjustment to incorporate the negative mobility of individuals of the lowest income classes, the percentage of individuals who managed to move in the direction of the higher income classes in the expanded matrix of absolute mobility is still high. With the exception of the seventh class, all of the percentages were above 50%, creating the hope of positive mobility for the six first classes. It is obvious that this statistic is meaningless for the last class.

The decrease in mobility which we observed upon moving from the matrix of absolute mobility to the matrix of relative mobility merits comment.

Relative mobility, by definition, cannot be very high. In order to ascend one income class within this mobility concept, the individual must have an increase, in real terms, exceeding the average increase. This necessarily implies that another parcel of the population lost income in relative terms, by the very definition of the term average gain. Thus, in this mobility matrix, it is interesting to observe that the larger percentages of positive mobility are to be found in the first two lower income classes, and that they are significantly greater than the percentages observed for the fifth, sixth, and seventh classes. This suggests that an adjustment in the income profiles is taking place, at least in the sense of containing increases in inequality.

In the case of the matrix of relative transition, the percentages of negative mobility, as may be observed, systematically exceed the percentages of positive mobility, even for the first classes. This

is reflected as an *expected jump* statistic. This measure reveals a negative expected value for all classes, which in principle could suggest a tendency of deterioration of the income distribution. However, a more careful analysis shows that this result is due to the definition of the matrix, as well as the methodology used in the determination of the income classes.

It should be noted in the results in Section 2, that the average of gross earnings in the sample grew at a rate superior to that of the *per capita* income during the period.

Observe in Table 13 that the percentages of positive mobility are inferior to the percentages of negative mobility (in relative terms). It may be concluded from these two observations that the income increases are, on the average, superior to income losses, on the average. This is compatible with an income distribution assymetric to the right. However, this is not evidence of a deterioration of the income distribution in relative terms. The same statistic, computed with the matrix of origin is positive for all income classes, as will be seen in the next Section. The joint analysis of the concepts of absolute and relative mobility is extremely important, because it clearly reveals the errors of interpretation that a simple statistical observation of inequalities can create.

Upon observing that positive mobility is relatively small in the matrix of relative mobility, we may simultaneously note that in the matrix of absolute mobility a substantial portion of the population received increases in income in real terms. This gave rise to the expectation of positive mobility, as may be observed in the statistic EJ corresponding to that matrix. This result is particularly important by virtue of the quality of our data which allow us to accompany the same set of individuals over time, rather than a portion of the population whose composition is altered. In previous studies, similar affirmations were made regarding deciles, income strata, but not with respect to the same individuals, as referred to here.

This confrontation of results does not give us an idea as to how the dynamic forces operate in the labor market throughout the development process, within the population stratum represented by our sample.

Accelerated income growth [16] during the period covered by our analysis allowed a large percentage of the employed population [17]

16 The product's rates of growth during the years covered by the analysis were: 1970 — 9.5%, 1971 — 11.3%, 1972 — 10.4%, 1973 — 11.3%, 1974 — 9.6%, and 1975 — 4.0%.

17 When we refer to the positive mobility of the employed population, we are alluding to our sample, because the sample refers to employed albor, dealing with the same individuals who declared income in 1970 and 1975.

Table 13

Expanded Matrix of Relative Transition

Income Classes 1970	Negative Mobility	Income Classes — 1975												Positive Mobility
		$\bar{3}$	$\bar{2}$	$\bar{1}$	0	1	2	3	4	5	6	7	8	
1	0.42	0.034	0.053	0.104	0.228	0.302	0.180	0.070	0.023	0.006				0.28
2	0.41		0.031	0.047	0.092	0.241	0.315	0.101	0.060	0.017				0.27
3	0.41			0.030	0.046	0.094	0.236	0.330	0.198	0.057	0.009			0.26
4	0.39				0.025	0.039	0.080	0.236	0.355	0.197	0.049	0.010		0.26
5	0.42					0.03	0.05	0.11	0.23	0.30	0.18	0.04	0.01	0.23
6	0.47					0.02	0.03	0.05	0.11	0.26	0.34	0.14	0.04	0.18
7	0.55					0.01	0.02	0.04	0.07	0.14	0.27	0.29	0.15	0.15
8	0.52					0.01	0.02	0.02	0.05	0.08	0.13	0.21	0.48	

Table 14

Statistics of Relative Mobility I

Summary of Statistic Computed from Date of Table 13

Income Classes	NLM	PM	NM	PAJ	NAJ	EJ
1	0.30	0.28	0.42	1.48	—1.75	—0.32
2	0.32	0.27	0.41	1.36	—1.68	—0.32
3	0.33	0.26	0.41	1.28	—1.68	—0.34
4	0.35	0.26	0.39	1.27	—1.62	—0.31
5	0.36	0.23	0.42	1.26	—1.71	—0.43
6	0.34	0.18	0.47	1.22	—1.81	—0.63
7	0.29	0.15	0.55	1.00	—1.96	—0.93
8	0.48		0.52		—2.31	—1.20

to receive increases in income in real terms. However, within this positive shift there occur changes in relative positions which actually translate the differentials of possibility of appropriation of the additional generated income. [18]

These differentials of the possibilities of appropriation of income fundamentally reflect the best utilization of the opportunities offered by the expansion of the labor market by the most skilled individuals. The causal relation between the existence of these excess gains in income and the unbalanced growth of the labor market is endorsed by the increase of the share of labor income in the total earnings of the individuals composing our sample between 1970 and 1975.

As was seen in Table 4, in 1970 labor income represented more than 80% of the earnings of the individuals of the first five classes, this percentage falling to only 79%, 72% and 61% for the individuals of classes 6, 7, and 8 respectively. Furthermore, it is worth remembering that the share of labor income in total income increased for all income classes in 1975, as may be seen in Table 5.

5 — Mobility among income classes: the expanded matrix of origin

In the previous section, we analyzed only the redistributive aspects of economic growth, i.e. the mobility of the labor market already

18 The data utilized do not allow for distinction between transitory gains in income and the concept, in fact relevant, which would be permanent income. Therefore, the interpretation of the degree of mobility, both absolute and relative, should keep this limitation in mind.

employed among the diverse income classes. With the methodology utilized, it was impossible to estimate negative mobility of the lower income classes. However, in order to have a better understanding of this phenomenon, it would be interesting to also study the origins of the individuals who composed the diverse income classes in 1975. This study was presented in Section 3 as an estimation of the matrixes of origin. We then verified that by virtue of the exemption limits, we did not have information regarding the lower origin of the individuals who were within the income classes in 1975.

In terms of income classes, the origin of the individuals comprising the first classes in 1975 is highly important, since it is reasonable to expect that it is there that we should find those who had a still lower income level in previous years, as well as a large portion of those who are entering the labor market for the first time. [10]

Thus, the study of the origin of the individuals who were among the first income classes in 1975 could be useful to distinguish two different phenomena and which are part of the effects of economic development on income distribution: the mobility of the low population strata, and the absorption of new individuals in the labor market.

Upon analyzing the two samples for 1975, in other words, the sample containing all income tax payers [20] in 1975 and that which only takes into consideration those who declared income in 1975 and who also declared in 1970, we observed that there exists a difference in frequency between both, by income class (see Table 1 in the statistical annex).

This difference actually encompasses all of the individuals who in 1970 received earnings below the exemption level as well as those who did not participate in the labor market and who entered during the period covered by our analysis, i.e. between 1970 and 1975.

Our objective is to dissociate these two phenomena with the intention of first analyzing the origins of the lower income classes, in other words, the degree of mobility in the labor market in the lower income stratum; and second, to study the distribution of the elements having recently entered the labor market.

Here we will develop a methodology to estimate the origins of the individuals who comprised the first income classes of 1975, but

[10] The first income class in 1975 corresponds to 26 thousand cruzeiros per year or 2 thousand cruzeiros per month. At the time, this amount was the equivalent of 3.75 minimum monthly wages. Therefore, the new individuals to whom we are referring and who were absorbed by the labor market are workers with some level of skill.

[20] "Taxpayer" is understood to be the individual with gross earnings above the exemption level.

who were already in the labor market in 1970, having been excluded from the statistics merely because they did not attain the exemption level that year.

5.1 — Methodological description and empirical results

In Section 3, we analyzed two matrices of origin which we shall call the matrix of absolute origin and the matrix of relative origin.

For the purposes of this analysis, we shall only work with the matrix of relative origin, since we believe that this concept of mobility maintains the closest relationship with the change in real income in relative terms.

Our objective is to estimate a triangle of origin which, together with this matrix, provides us with the origins of the first classes of 1975, in other words, to construct a trapezium, as illustrated in Table 15.

In this trapezium, the element $d_{\bar{3}1}$ represents the percentage of individuals of class 1 in 1975 who originated in class $\bar{3}$ in 1970. The element $d_{\bar{2}1}$ represents the percentage of individuals of class 1 in 1975 who originated in class $\bar{2}$ in 1970 and henceforth.

We also believe that the origin of four low classes would be sufficient to explain the phenomenon of the individuals who were

Table 15

Trapezium Of Origin

Income Classes 1970	Income Classes — 1975							
	1	2	3	4	5	6	7	8
−3	$d_{\bar{3}1}$							
−2	$d_{\bar{2}1}$	$d_{\bar{2}2}$						
−1	$d_{\bar{1}1}$	$d_{\bar{1}2}$	$d_{\bar{1}3}$					
−0	d_{01}	d_{02}	d_{04}					
1	d_{11}	d_{12}	d_{13}	d_{14}	C_{15}	C_{16}	C_{17}	C_{18}
2	d_{21}	d_{22}	d_{23}	d_{24}	C_{25}	C_{26}	C_{27}	C_{28}
3	d_{31}	d_{32}	d_{33}	d_{34}	C_{35}	C_{36}	C_{37}	C_{38}
4	d_{41}	d_{42}	d_{43}	d_{44}	C_{45}	C_{46}	C_{47}	C_{48}
5	d_{51}	d_{52}	d_{53}	d_{54}	C_{55}	C_{56}	C_{57}	C_{58}
6	d_{61}	d_{62}	d_{63}	d_{64}	C_{65}	C_{66}	C_{67}	C_{68}
7	d_{71}	d_{72}	d_{73}	d_{74}	C_{75}	C_{76}	C_{77}	C_{78}
8	d_{81}	d_{82}	d_{83}	d_{84}	C_{85}	C_{86}	C_{87}	C_{88}

in the labor market in 1970 and were excluded from the sample as their income was below the exemption level.

The analysis of the differences in frequency by income class and between the sample containing all of the individuals and that containing only the same individuals, nevertheless reveals an excessive difference among the first classes which diminishes until becoming practically insignificant in the eighth class.

These differences, however, encompass the two phenomena which we wish to distinguish, in other words, part of the difference results from the entrance of new individuals into the labor market during the period covered by the analysis, and the other is due to entrance of individuals who were already in the labor market in 1970, but who were excluded from the sample as they received income below the exemption limit.

By virtue of the hypothesis that the origin of four low classes would be sufficient to detect the origin of the individuals excluded from the sample (but who were already in the labor market), the differences among the frequencies of the samples for classes 5, 6, and 7, and 8 will be considered as representative of the individuals who entered the labor market during the period.

These differences, divided by the frequencies of the sample containing all of the individuals, gives us the percentage of entrance to the labor market which we will call PIM. This variable takes on the values 14.4%, 9.28%, 8.25% and 6.87% for the fifth, sixth, seventh, and eighth classes, respectively.

It remains for us to estimate the percentages of those who entered the market in the first classes. However, in order to obtain these values, we must first develop a methodology which allows us to estimate the percentage of the individuals who were among the first four income classes in 1975 and who originated in lower classes. Once these percentages are obtained, we will then be able to estimate the percentages of persons having entered the labor market by residual.

The difficulty in making this estimate is that, contrary to what occurred in Section 4, we do not have the exact number of persons having originated in the lower income classes, because now the difference between the samples encompasses not only those who originated in the lower classes, but also those new participants in the labor market. In order to isolate the two phenomena, we have at our disposal only the probabilities of origin of the lower classes, included in the matrix of relative origin, estimated in Section 3. Thus, these probabilities take on a critical role in our methodology, and consequently require an analysis of greater depth.

This measure of greater care is necessary due to the fact that, in our analysis, we have worked with a sample which may be considered a representative of the tail of a Pareto distribution. The observed patterns of behavior refer to the highest income strata. In attempting to extrapolate for the low limit of the distribution the observed patterns of mobility in our sample, we risk committing an error, since, as we know, the income distributions have diverse profiles in the interval corresponding to low income groups.

When working with observations referring to the tail of the Pareto distribution, i.e. with a sample in which the income level is relatively high, the frequencies, by income class, tend to decrease to the extent that we move towards the high strata. This phenomenon makes the positive percentages of mobility, measured by the matrix of transition, substantially smaller than the corresponding inferior percentages of origin, measured by the matrix of origin, i.e. if N_{ij} individuals move from class i to class j, in the period under consideration, the element a_{ij} in the matrix of transition would be defined as $\frac{N_{ij}}{N_j}$, while element c_{ij} of the matrix of origin would be defined as $\frac{N_{ij}}{N_j}$. Thus, as that $N_i > N_j$, we will obtain $a_{ij} < c_{ij}$.

This discrepancy between the two measures of mobility tends to decrease when it approximates the median of the distribution which, in the case of the income distribution, is located at the lower income levels. The reason for this reduction is the smaller difference between the frequencies among successive income classes.

Similarly, upon considering an income distribution by deciles, we observe that, in the interval corresponding to the distribution tail, the average earnings of the deciles tend to increase exponentially. In the interval corresponding to the median, the rate of growth of the average earnings between the deciles is practically constant. This is evidence of the fact that the observations refer to a segment near the distribution median.

In the study entitled, *Distribuição da renda e desenvolvimento econômico,* Langoni [21] presents the average earnings by deciles, from an income distribution obtained from census data.

Table 16 shows the results obtained by Langoni and the third column wich was calculated by us.

[21] Langoni (1973), p. 21, Table I.1.

Table 16

Rates of Growth of Average Income by Deciles

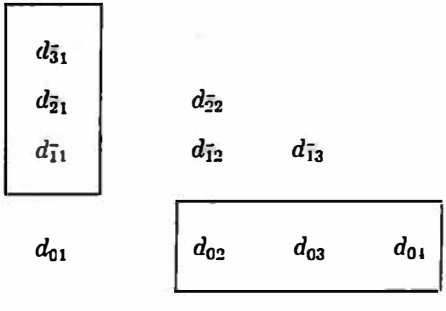
Decile	Average Income in 1970 Cruzeiros monthly	Rate of Growth of Income
10—	32,69	
10	57,86	76,9
10	84,65	46,3
10	107,41	26,9
10	141,54	31,7
10	173,87	22,8
10	203,23	16,8
10	280,59	38,1
10	426,89	52,1
10+	1.309,87	206,8

SOURCE: Langoni (1973), p. 21, Table I.1.

As may be observed, the rates of growth of average incomes among deciles stabilize between the fourth and the seventh decile. In this interval, average income is 100 cruzeiros to 200 cruzeiros per month, corresponding to 1,300 to 2,600 cruzeiros per year. This value shows that within the classes taken into consideration in this analysis, the frequencies by income class should stabilize below the lower limit of our sample, in other words, the percentages of transition approximate the percentages of origin only for the first classes.

Thus, only in the low limit of our distribution N_i approximates N_j and therefore, a_{ij} in the matrix of transition approximates c_{ij} in the matrix of origin.

Our objective is to estimate a triangle, as described below:



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This discrepancy between the two measures of mobility tends to decrease when it approximates the median of the distribution which, in the case of the income distribution, is located at the lower income levels. The reason for this reduction is the smaller difference between the frequencies among successive income classes.

Similarly, upon considering an income distribution by deciles, we observe that, in the interval corresponding to the distribution tail, the average earnings of the deciles tend to increase exponentially. In the interval corresponding to the median, the rate of growth of the average earnings between the deciles is practically constant. This is evidence of the fact that the observations refer to a segment near the distribution median.

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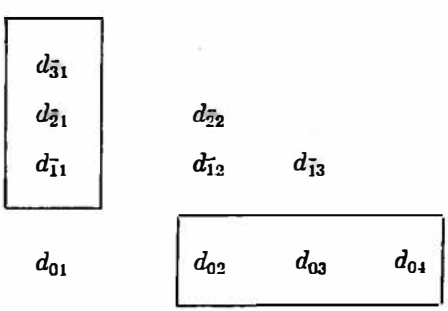
Thus, only in the low limit of our distribution N_i approximates N_j and therefore, a_{ij} in the matrix of transition approximates c_{ij} in the matrix of origin.

Our objective is to estimate a triangle, as described below:



The three elements framed by the rectangle at the base of the triangle, i.e. elements d_{02}, d_{03}, and d_{04} may be estimated based on the information contained in the original matrix of origin, since it refers to the superior extremity of the tail of the Pareto distribution. Furthermore, the great stability of elements c_{ij} in the matrix of origin for $i = j - 2$, $i = j - 3$, and $i = j - 4$ suggest that the values of these diagonals should be adopted as probabilities of origin of two, three and four lower classes. Thus, we took the average of the values of corresponding the diagonals and estimated the values d_{02}, d_{03}, and d_{04}. However, the elements of the vertical cathetus of the triangle $d_{\bar{3}1}$, $d_{\bar{2}1}$, and $d_{\bar{1}1}$ refer to the individuals who, in the first income class in 1975, originated in even lower income classes. Therefore, the extrapolation of the behavior patterns of these individuals in effect for the tail of the distribution does not seem to be adequate. Thus, for the purposes of this estimation, we took the information from the first line of the matrix of transition (Table 8).[23]

As we stated previously, at the low income levels (i.e. near the distribution median) the percentages of mobility measured by the matrix of origin should approximate those estimated with the transition matrix. For this reason, we took elements a_{13}, a_{14} and a_{15} of the matrix of transition as the estimators of the elements $d_{\bar{1}1}$, $d_{\bar{2}1}$ and $d_{\bar{3}1}$ of the triangle to be coupled to the matrix of origin, since those elements represent probabilities of two, three and four positive jumps.

We thus formed the following triangle:

0,01			
0,04	$d_{\bar{2}\bar{2}}$		
0,12	$d_{\bar{1}\bar{2}}$	$d_{\bar{1}\bar{3}}$	
d_{01}	0,18	0,09	0,04

where the values d_{01}, $d_{\bar{2}\bar{2}}$, $d_{\bar{1}\bar{2}}$ and $d_{\bar{1}\bar{3}}$ still need to be estimated.

We know that elements $d_{\bar{3}1}$, $d_{\bar{2}\bar{2}}$, $d_{\bar{1}\bar{3}}$ and d_{04} of the triangle (i.e. the elements of the hypotenuse) are the probabilities of origin

[23] Even considering the elements of the first line of the matrix of transition, we are still extrapolating for classes 0, —1, —2, and —3 the mobility patterns of class 1 which, as we know, corresponds to level of 3.75 minimum wages. To the extent that these individuals have a level of skill superior to that of the individuals from lower classes, the evidence regarding the format of the income age profiles, by level of skill, suggest that perhaps we are overestimating the degree of mobility, since the profiles usually increase more slowly the lower the educational level. This is, however, the only information we have available.

from four inferior classes. We have two estimates from these elements, one from the transition matrix ($d_{\bar{3}1}$) and the other from the origin matrix (d_{04}). We estimated the values $d_{\bar{2}2}$ and $d_{\bar{1}3}$ by interpolation, resulting in the values 0.02 for $d_{\bar{2}2}$ and 0.33 for $d_{\bar{1}3}$. The interpolation was used because, to the extent that we shift from d_{04} to $d_{\bar{3}1}$, we leave the tail of the distribution to penetrate the interval corresponding to the low incomes.

Element d_{12} of the triangle, similarly, was estimated by the average between the elements $d_{\bar{2}1}$ and d_{03} of the triangle which correspond to the elements a_{14} of the transition and origin matrices, respectively. This procedure gave us a value of 0.07.

Element $d_{\bar{1}2}$ remains to be estimated. For this purpose, we took the values a_{12} of the matrices of transition and origin for Tables 8 and 10 and we calculated the average, which resulted in the value 0.33.

Using this methodology, the complete triangle would be:

0,01			
0,04	0,02		
0,12	0,07	0,03	
0,33	0,18	0,09	0,04
0,50	0,27	0,12	0,04

Upon incorporating this triangle to the matrix of origin, we must adjust the elements of the first four columns so that they continue to sum 1.

The expanded matrix of origin appears in Table 17.

5.2 — The expanded matrix of relative origin

Table 17 shows the expanded matrix of relative origin, following the adjustments imposed by the incorporation of the triangle corresponding to the lower origin of the first four classes.

As may be observed, the percentages of inferior origin (positive mobility) are significantly greater than those of superior origin. These results, since they refer to the same phenomenon previously analyzed by the matrix of transition, are extremely important, since they show that the small percentages of positive mobility observed [24] are basically the result of the manner in which the matrix is constructed, given the growth of the frequencies which are usually observed by income class, as we move in the direction of the higher

[24] See Table 13.

Table 17

Expanded Matrix of Relative Origin

Income Classes 1970	Income Classes — 1975							
	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8
—3	0,01							
—2	0,04	0,02						
—1	0,12	0,07	0,03					
0	0,33	0,18	0,09	0,04				
1	0,295	0,256	0,16	0,08	0,04	0,02	0,01	0,01
2	0,155	0,300	0,28	0,16	0,08	0,04	0,03	0,02
3	0,035	0,131	0,29	0,30	0,17	0,08	0,05	0,03
4	0,010	0,029	0,11	0,30	0,31	0,18	0,09	0,05
5	0,005	0,007	0,03	0,10	0,28	0,32	0,19	0,09
6			0,01	0,02	0,08	0,26	0,31	0,16
7					0,02	0,08	0,23	0,24
8					0,01	0,02	0,09	0,40
Low Origin	0,50	0,52	0,56	0,58	0,60	0,64	0-68	0,60
High Origin	0,21	0,17	0,15	0,12	0,11	0,10	0,09	

income strata. The percentages of mobility in the matrix of transition refer to the classes of origin, while in the matrix of origin, they are related to the classes of destination.

Based on the expanded matrix of relative origin, the following statistics were calculated:

1. Stable Origin
   $SO = d_{ij}$, for $i = j$
2. High Origin
   $SO = \sum_{i > j} d_{ij}$

This measure gives us the total probability that the individuals of class j in 1975 originated in income classes superior to j in 1970.

3. Low Origin

$$LO = \sum_{i<j} d_{ij}$$

This measure gives us the total probability that the individuals of class in 1975 were from classes inferior to j in 1970.

4. Average Ascending Origin

$$AAO = \left(\sum_{i<j} d_{ij} \, [i - j] \right) \div \sum_{i<j} d_{ij}$$

This measure shows the average number of classes that the individuals of class j in 1975 reached since 1970.

5. Average Descending Origin

$$ADO = \left(\sum_{i>j} d_{ij} \, [i - j] \right) \div \sum_{i>j} d_{ij}$$

This measure shows the average number of classes that the individuals of class j in 1975 descended to since 1970.

6. Expected Jump

$$EJ = \sum_{i} d_{ij} \, (j - i)$$

This statistic shows how many classes it is expected that individuals from class j had to jump in 1975, from their 1970 origin in order to reach j.

The results summarized by statistics presented here, contained in Table 18, merit comment. As may be observed, the percentages of low origin are substantially greater than those percentages of high origin. This means that the majority of individuals comprising the diverse 1975 income classes originated in lower income classes. This fact is reflected in the statistic which we call the *expected jump,* which is positive for all income classes.

This result complements and clarifies the results obtained in Table 14, when we found the expected jump statistic with negative values for all income classes.

The apparent contradiction in the results is a phenomenon characteristic of the dynamic processes which are even compatible with the long-run stability of distribution. This phenomenon results from the fact that the percentages of positive mobility corresponding to the classes of origin in the matrix of transition are smaller than the corresponding percentages of low origin, which are related to the destination classes in the matrix of origin.

Table 18

Statistics of Relative Mobility II
Summary of the Statistics Obtained Using the Expanded Matrix of Relative Origin

Income Classes	SE	SO	IO	AAO	ADO	EJ
1	0,30	0,21	0,50	1,46	1,31	+0,46
2	0,30	0,17	0,52	1,74	1,24	+0,70
3	0,29	0,15	0,56	1,77	1,33	+0,79
4	0,30	0,12	0,58	1,76	1,17	+0,88
5	0,28	0,11	0,60	1,75	1,36	+0,90
6	0,26	0,10	0,64	1,84	1,20	+1,06
7	0,23	0,09	0,68	2,01	1,00	+1,26
8	0,40	0,00	0,60	2,28		+1,37

5.3 — Labor absorption by income classes

The analysis which we have conducted until this point deals with the expansion of the intersection sample of the years 1970 and 1975, aiming to incorporate the individuals who had been excluded for not attaining the exemption level.

As a sub-product of the methodology, it was also possible to identify the distribution, by income class, of the individuals who entered the labor market during the period covered by the analysis. We had the PME statistic (Percentages of Market Entries) for classes 8, 7, 6, and 5. This statistic for classes 4, 3, 2, and 1 remains to be estimated.

The sum of these four lines of the triangle which was incorporated into the matrix is 0.50, 0.27, 0.12, 0.04 for the first, second, third and fourth classes, respectively.

We should therefore estimate the frequencies effective in 1975 based on the absolute frequencies of these classes in the sample containing the same individuals. By effective frequency, we mean all the individuals who belonged to classes 1, 2, 3, and 4 in 1975, including those who, in the sample of the same individuals, were excluded for having been below the exemption level in 1970, but who were in the labor market in 1970.

This estimate was made with the following two calculations:

$$\overset{75}{F}_{E_j} = \overset{75}{F}_{M_j} \div \left(1 - \sum_{i<0} d_{ij}\right), \text{ for each } j.$$

where

$\overset{75}{F}_{E_j}$ = Effective frequency of class j in 1975

$\overset{75}{F}_{M_j}$ = Frequency of class j in 1975 in the sample containing the same individuals (Column B of Table 2 in the statistical annex).

Table 19 shows the results of these estimates.

Since the estimates of the effective frequencies for 1975 (Column C in Table 19), we may calculate the number of individuals who should have entered the labor market for the first four income classes by simply subtracting the effective frequencies from the absolute frequencies from the sample containing all of the individuals. This result is in Column D of Table 19. With this information, we may obtain the PME statistic (Percentage of Market Entries) for the first classes, whose result is found in Column E.

Table 19

Percentage of Market Entries: Methodological Example

Income Classes	Absolute Frequencies in the Sample Containing All Individuals (A)	Absolute Frequencies in the Sample Containing the same Individuals (B)	Effective Frequencies 1975 = Column B of this Table Divided by $(1 - \Sigma d_{ij}$ for $i<0$ (C)	Individuals Who Entered the Labor Market (D) = (A)-(C)	PME Statistic PME = (D) : (A) (E)
1	1.043.496	398.527	797.054	246.442	23,6
2	699.338	390.490	534.917	164.421	23,5
3	431.749	301.997	343.178	88.571	20,5
4	248.403	196.866	205.068	43.335	17,4

SOURCE: Table 1 of the Statistical Annex.

The PME statistic for the eight classes appears in the table below:

Table 20

Percentage of Entries

Income Classes	PME
1	23,6
2	23,5
3	20,5
4	17,40
5	14,40
6	9,28
7	8,25
8	6,87

We can thus calculte the frequency distribution by income class for the individuals having recently entered the labor market. The results are presented in Table 21.

Since information regarding the individual incomes of these new workers is not available to us, this table does not allow for a

Table 21

The Distribution of Income: New Workers

Income Classes 1975	Individuals Who Entered the Labor Market During the Period Covered by the Analysis (A)	Relative Frequency (%)
1	246.442	43,41
2	164.421	28,96
3	88.508	15,59
4	43.222	7,61
5	18.107	3,19
6	4.826	0,85
7	1.498	0,26
8	637	0,11
Total	567.661	

SOURCE: Table 10 (first four lines, Column A); and Table 1 of the Statistical Annex.

more in-depth study on the income distribution of this segment of the labor force. However, it would doubtlessly be worthwhile that in future studies a disaggregated analysis be conducted of the distribution of the new participants, even for occupational categories. This would certainly complement the evidence on the effects of the unbalanced growth of the labor market on the distribution of real income in Brazil, during recent years.

6 — Final coments

The central objective of this study was to the provide empirical evidence of a phenomenon which is frequently cited in studies on income distribution, but which is rarely measured: inter-income class mobility.

Due to the essentially dynamic characteristics of economic development, its positive effects are usually underestimated when analyzed in a statistical comparison of two distinct moments in time.

With the income tax data, we were able to select samples for 1970 and 1975 which were compatible with the demands of the construction of mobility matrices, such matrices being the adequate instrument for the analysis of income distribution in a dynamic context.

The concentration of income which usually occurs in the initial stages of the development process may create social tension among the classes which have as yet to benefit from development, and the probability that such tension arises, as well as the time period necessary to its emergence, are inversely proportional, among other factors, to the society's degree of mobility.

Hirschman (1973) in analyzing this phenomenon, gave the name "tunnel effect" to the fact that individuals, although not benefiting from development in its initial stages, receive utility gains resulting from the positive future expectations. The analogy he established uses the image of a tunnel during a traffic jam in which individuals in the left lane, although their vehicles are immobilized, are pleased to see that the right lane is moving. This increase in satisfaction is resultant of the expectation that their automobiles will soon begin to move as well.

In social terms, a high degree of mobility among income classes would cause this same type of expectation among the lowest income groups, thus allowing for a socially peaceful coexistence with the transitory increase in relative inequality.

The phenomenon of inequality with mobility helps to explain why certain societies undergo the transformations inherent to eco-

nomic development with a reasonable degree of social and political stability, while in others this has not been possible.

Mobility among income classes is a determinant of income distribution. In relative terms, it allowed for a fairly precise visualization of the income distribution transformation processes overtime in the Brazilian economy. Traditional analysis, with their synthetic measures of inequality, provide little evidence of the constant gains and losses of position, in relative terms, which result in the adjustment processes of the market forces in a dynamic context.

In creating opportunities of upward income mobility, economic development allows increasing percentages of individuals from lower income classes to appear in the higher classes. This observation is evident in the expanded matrix of origin.

Likewise, in the matrix of transition, a loss in the relative position of some individuals in various income groups is observerd as well.

Taken together, these phenomena project the idea of ambiguity which usually arises when one attempts to judge the losses or gains of social well-being based on the statistic measures of inequality. Since the composition of income classes is altered over time, the fact that the decile of the highest income increases its relative share does not necessarily mean that the same portion of the population, i.e., the same group of individuals took possession of a large portion of the national income.

As may be observed in the expanded matrix of origin, 60% of the individuals who comprised the fifth income class in 1975 (Cr$ 14,286 to Cr$ 21,168 per month) came from lower classes, while 31% came from the fourth class (Cr$ 9,461 to Cr$ 14,286 per month), 17% from the third (Cr$ 6,506 to Cr$ 9,461 per month), 8% from the second (Cr$ 4,391 to Cr$ 6,506 per month) and 4% from the first (Cr$ 2,963 to Cr$ 4,391 per month). These shares of lower income class origin increase up to the sixth class when they reach 68%.

The natural conclusion is that it is more important to maintain open the channels of social mobility — which is only possible maintaining high rates of income growth — than to permanently control Gini indices or other conventional measures of income inequality.

If to the mobility aspects is added the problem of the absorption of new entrants in the labor market it is clear that only through continuous and accelerating growth will be possible to assure job creation which is, in the last instance, one the main determinants of future income distribution.

Statistical annex

Table 1

Absolute Frequencies by Income Classes — 1970 *

Income Classes	Sample With All Individuals	Sample With the Same Individuals (2)	Sample With the Same Individuals (3)
1	868.967	448.021	613.954
2	582.724	428.729	472.114
3	338.946	283.310	293.613
4	191.784	167.551	170.636
5	94.181	83.934	84.900
6	39.985	35.829	36.132
7	15.078	13.418	13.494
8	8.136	7.177	7.224

SOURCE: Serpro/IRPF.

*Although they refer to the same year and the sample with the same individuals, columns (1) and (2), present different values because the intersection samples 1970-1975 encompass different individuals, depending on the income classes under consideration. According to the concept of absolute equivalence, the lower limit of the 1975 income classes is lower, and for this reason, the intersection sample is larger. Thus, the data in Column (1) were utilized to expand the matrix of absolute transition, and the data from Column (2) to expand the matrix of relative transition.

Table 2

Absolute Frequencies by Income Classes — 1975

Income Classes*	Sample With All Individuals (A)	Sample With the Same Individuals (B)
1	1.043.496	398.527
2	699.338	390.490
3	431.749	301.997
4	248.403	196.866
5	125.745	107.606
6	52.008	47.178
7	18.163	16.663
8	9.281	8.643

SOURCE: Serpro/IRPF.

* Income classes defined according to the concept of relative equivalence.

Monetary policy in the context of price indexation: the Brazilian case *

Carlos Alberto Reis Queiroz **

In the 1930's, when widespread unemployment was the economic malaise threatening the foundation of free society, professor John Maynard Keynes, of King's College, prescribed fiscal activism as a cure. Now, in the 1970's rampant inflation is seen by some to threaten the viability of free society. Professor Milton Friedman, of the University of Chicago, has prescribed indexation as an effective expedient to preserve free society. (Yang, Jai-Hoom, The Case for and Against Indexation: An Attempt at Perspective. Federal Reserve Bank of St. Louis Review, *October 1974, p. 2).*

1 — Preliminary considerations

In 1974, Professor Milton Friedman of the University of Chicago, wrote an article entitled "Using Escalators to Help Fight Inflation" for *Fortune* magazine. [1] And just after wards another article published by the American Enterprise Institute for Public Policy Research [2]

Editor's note: Translation not revised by the author.

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1 Friedman, 1974*a*.

2 Friedman, 1974*b*.

where he advocated the use of monetary correction as a means to avoid, if not diminish, the transitory recessive phase caused by restrictive economic policy to combat inflation.

The hypothesis formulated by Friedman in these two articles is that in an indexed economic system, the adverse collateral effects of restrictive monetary policy are reduced.

Friedman's hypothesis is based upon several of his previous studies, [3] which suggest that there exists a short-run conflict between inflation and unemployment as a consequence of the divergence between the inflation rate expected by the economic agents (on which they base their decisions) and the inflation rate which actually occurs. Such hypothesis developed in the studies by Friedman have come to incorporate what is known as the modern quantitative theory of money. [4]

Modern monetarism suggests that, since the expected inflation rate does not coincide with the inflation rate that actually occurs due to errors, the short-run effects of a given monetary policy will be felt, at least partially, in quantity adjustments (rate of growth of the real product) and subsequently in price adjustments (inflation rate). In the long-run, however, once the errors are perceived and corrected, the price variation absorbs the total effect of the monetary policy and real output returns to its potential value. In other words, the economy would function at the level given by the desired use of the economy's real resources.

Based on the exchange equation $MV = PX$, this theoretical proposition may be described, to the extreme, as an indication that in the short-run, the elasticity of the rate of growth of the real product in relation to the rate of growth of money stock is unitary $- e_c(\dot{X},\dot{M}) = 1 -$, while the elasticity of the rate of growth of prices in relation to the money stock is null $- e_o(\dot{P},\dot{M}) = 0$.

Friedman's hypothesis is that monetary correction, in itself, cannot neither increase nor decrease the inflation rate. The only effect is can have is to approximate the short-run position (generated by a given spending policy) with long-run behavior. In contrast with that of the previous paragraph, this hypothesis affirms that the elasticity of the rate of growth of real output in relation to the rate of growth of the money stock is null $- e(\dot{X},\dot{M}) = 0 -$, and the elasticity of the rate of growth of prices in relation to the rate of growth of the money stock is unitary $- e(\dot{P},\dot{M}) = 1$. [5]

[3] Friedman, 1968, p. 1-7.

[4] Andersen, 1970; Laidler, 1975.

[5] Anderson and Karnoski, 1972, p. 151.

As an empirical consequence, the idea that the collateral effects of monetary policy are abated in an indexed economy may be interpreted as the hypothesis that monetary correction makes expected inflation approach real inflation more rapidly. This would correspond to the hypothesis that, adjustments occur more rapidly on the short-run Phillips curve towards the long-run position (vertical Phillips curve) in an indexed economy. Thus, the adjustment velocity of expected inflation to real inflation would be greater in an indexed economy. [6] Another alternative, though not mutually exclusive with regard to the first theory is that in a perfectly indexed economy, it is senseless to speak of a short-run Phillips curve defined for a specific value of the expected inflation variable. Since both prices and wages are automatically corrected by monetary correction, inflation will not provoke a change in relative prices, not even in the short-run. In other words, the Phillips curve would be vertical in a perfectly indexed economy, and there would be no need to create expectations.

Thus, in principle, monetary correction would have two effects on the price formation process. The first would render the short-run Phillips curve more vertical, and the second would make the adjustment process between the expected rate of inflation and the actual rate more rapid, i.e. the short-run Phillips curve would adjust more rapidly to the long-run position.

2 — The Phillips curve and its empirical trend

Many theoretical and empirical research studies have been developed on the endogenous process of the determination of the inflation rate [7] based on the 1958 study by Phillips. [8] Pioneer studies generally presented the nominal wage variation rate as a function of the unemployment rate, used as a proxy for excess demand in the labor market, as indicated in equation (1)

$$W_t = \gamma + \theta\, u_t \qquad (1)$$

where:

W_t = rate of variation of the nominal wage, in period t.

u_t = the rate of unemployment in period t.

We subsequently attempted to include other explanatory variables, such as unemployment dispersion, price changes, labor union

[6] Lemgruber, 1977.

[7] Phillips, 1958, p. 283-299.

[8] For a complete review of these studies, see Santomero and Seater, 1977 and Lemgruber, 1974, p. 37-46.

bargaining power and productivity, among others. A considerable advance in the study of the Phillips curve resulted from the natural unemployment rate hypothesis of Friedman and Phelps. [9] Based on these contributions, one additional variable came to be used in the specification of the original equation. This variable was to measure the expected future inflation rate.

$$W_t = \gamma + \theta\, u_t + \alpha P_t^a \qquad (2)$$

where:

P_t^a = expected future inflation rate, formed in period t.

Prior to this specification, Samuelson and Solow used a Phillips curve as an economic policy instrument, establishing a negative correlation between inflation and the rate of unemployment. [10] They believed that the inflation rate was adjusting to the excess demand in the goods and services market. The rate of unemployment was used as a (negative) index of excess demand, no longer in the labor market but rather in the goods and services market. With this procedure, economic authorities would be able to choose between alternative points with different inflation and unemployment rates along the Phillips curve.

Another specification of the Phillips curve was reached with Samuelson and Solow's consideration of the dependent variable, the inflation rate. Now the dependent variable is the rate of inflation rather than the nominal wage variation:

$$P_t = \gamma + \theta\, u_t + \alpha P_t^a \qquad (3)$$
$$\theta < 0 \quad \alpha > 0$$

where:

P_t the real inflation rate;

P_t^a the expected future inflation rate, formed in period t.

Other authors then began to substitute the unemployment rate variable by the real output gap to represent excess demand. [11] This procedure was adopted due to the lack of unemployment statistics for some countries, and may be justified by Okun's study. [12]

9 Friedman, 1968, 1969; Phelps, 1976, p. 254-281, 1970, p. 1-26.

10 Samuelson and Solow, 1960, p. 177-194.

11 Lemgruber, 1974.

12 Okun, 1962, p. 98-104.

The equation was specified as follows:

$$P_t = \gamma + \theta\,(\text{Log } X_t^F - \text{Log } X_t) + \alpha P_t^a \qquad (4)$$
$$\theta < 0 \quad \alpha > 0$$

Where:

X_t^F — the potential product in period t.
X_t the real product in period t.

Equation (4) was utilized to test the accelerationist theory of inflation [13] after we added the adaptive type process of expectation formation. The test was conducted by estimating the equation and then by studying the magnitude of coefficient α. If the hypothesis $\alpha = 1$ is not rejected, we must accept the accelerationist theory that there is no long-run trade-off between the rate of price increases (or nominal wages) and the rate of idleness (or the rate of unemployment). If hypothesis $\alpha = 1$ is rejected, however, the existence of a long-run trade-off is accepted.

The consideration of the coefficient $\alpha = 1$ for the above-mentioned test is based on the following transformation of equation (4) :

$$P_t - \alpha P_t^a = \gamma + \theta\,(\text{Log } X_t^E - \text{Log } X_t) \qquad (5)$$

in other words, the real output gap is related to the difference between the expected and the real inflation rate. When these rates become equal, we have a vertical Phillips curve, i.e. the unemployment rate will be independent of the rate of inflation. If α is equal to 1, we have:

$$0 = \gamma + \theta\,(\text{Log } X_t^F - \text{Log } X_{t-1}) \qquad (6)$$

$$\text{Log } X_t^F - \text{Log } X_{t-1} = -\frac{\gamma}{\theta} \qquad (7)$$

Observe that equation (7) indicates that when expected inflation is equal to real inflation and $\alpha = 1$, the economy's rate of idleness is independent of the rate of inflation, being equal to $\left(-\frac{\gamma}{\theta}\right)$, corresponding to a natural rate of idleness, *à la* Friedman. [14]

[13] Lemgruber, 1974.
[14] Friedman, 1968, p. 2-17.

3 — The choice of a model

As described in the previous section the accelerationist theory has been developed with a single equation representing the Phillips curve.

With Brazilian data, we intend to test the hypothesis that the introduction of an indexing system would influence the much discussed conflict between inflation and unemployment. For this purpose, the use of a single equation is not sufficient. A model will have to provide more information, especially with regard to the effects of exogenous acts of the government on the economy.

Since there exists an immense number of models, the choice must be made according to specific criteria; two in particular, are of special importance. First, the chosen model must be destined to a specific use, in other words, there must be a research objective, so as to minimize the number of variables to be used. This procedure is doubtlessly preferable to using a general model, capable of dealing with a wider variety of problems. Second, even with a well-defined objective, it must be kept in mind that there are not only alternative processes, but also alternative variables to be utilized. In these conditions, only the empirical tests can provide the correct indication.

The model to be used in this study was developed by the Research Department of the Federal Reserve Bank of St. Louis, and we believe that it meets the above requirements since it is an extremely simple working instrument.

4 — The short-run test

The main implication of the accelerationist theory is that in the long-run, there is no conflict between inflation and unemployment, although this trade-off does exist in the short-run by virtue of the gap between real and expected inflation.

According to Friedman, the introduction of an indexing system would isolate the real sector of changes in the nominal sector of the economic system. Thus, the economic agents feel that they are protected from the distributive effects of the unexpected inflation.

An analysis of the St. Louis model will be useful for a better understanding of the short-run situation:

$$D\text{Log } Y_t = a_0 + b_0 \, D\text{Log } M_t \tag{8}$$

$$D_t = D\text{Log } Y_t - (\text{Log } X_t^P - \text{Log } X_{t-1}) \tag{9}$$

$$D\text{Log } P_t = a_1 + b_1 \, D_t + c_1 \, A_t \tag{10}$$

$$D\text{Log } Y_t = D\text{Log } X_t + D\text{Log } P_t \tag{11}$$

where:

M money
Y = nominal expenditure
D = demand pressure
P = price index
X real output
A = future price expectation

Within the model, the transmission occurs as follows: variations in the money stock (M) provoke variations in total expenses (Y). the elasticity of total expenditures in relation to money stock being $-e\ (Y,M) = b_o$.

As the model is recursive, variations in the money stock (M) are transmitted to prices (P) through demand pressure (D), the price elasticity in relation to money stock being $-e\ (P,M) = b_1 b_o$.

Equation (10) shows that two variables affect price formation process: the demand pressure variable and the future price expectation variable. The justification for the inclusion of the latter variable in the price formation process in the short-run is that the economic agents need to form expectations on future inflation in order to make their decisions. Variations in these expectations lead to short-run variations in prices.

The role played by the future price expectation variable in the short-run price formation process is the over-or under-estimation of the effects of government spending policy. Let us assume that inflation is expected to increase sharply in the future. In this case, prices will increase in a greater proportion than that which would have been caused by monetary policy alone; in other words, they would increase by:

$$b_1 b_o + c_1$$

Let us now assume that inflation is expected to decline in the future. In this case, prices should rise less than they had been only affected by monetary policy, in other words:

$$b_1 b_o - c_1$$

In the case of a perfectly indexed economy, the introduction of the future price expectation variable in the short-run price formation process is senseless when the economic agents feel protected from the distributive effects of unexpected inflation. This is due to the fact that the prices are automatically corrected by the monetary

correction instrument. Contracts are drawn in real terms, with clauses stipulating the automatic compensation of inflation. The economic agents must then form expectations on inflation before taking their decisions. In a situation of perfect indexation, the rate of inflation is irrelevant.

The test as to how monetary correction affects the short-run conflict between inflation and unemployment consists of verifying the magnitude and significance of the coefficient of the inflation expectation variable and of the coefficient of the demand pressure variable.

Thus, keeping the St. Louis model price equation in mind, it may be said that, if at the same time, $c_1 + b_1 = 1$, $c_1 = 0$ and $b_1 = 0$, the monetary variations will be directly transmitted to prices without affecting real output. If at the same time, $c_1 + b_1 = 1$, $c_1 = 1$ and $b_1 = 0$, the monetary variations will be directly transmitted to real output, without affecting prices.

In the second case, $c_1 + b_1 = 1$. In terms of the traditional Phillips curve (in other words, a price equation which uses the real output gap H_t rather than demand pressure variable D_t), this equals $\alpha = 1$.[15] Although there is a short-run conflict between prices and unemployment, in this case the curve becomes vertical and the trade-off disappears in the long-run.

The traditional test of the accelerationist theory is therefore concerned with studying the existence of a long-run trade-off between inflation and unemployment while the test which we have just mentioned attempts to confirm the existence of a short-run trade-off.

Thus, if the magnitude of the coefficient of the expectation variable for the indexed period were statistically less than during the non-indexed period, and if the magnitude of the coefficient of the demand pressure variable were greater, this would be an indication that the expectations will begin to have less influence in the short-run price formation process and that the monetary variations will increase in influence.

[15] It can be proved that the traditional Phillips curve equation

$$DLogP_t = \delta - \theta H_t + \alpha A_t$$

Where:

H_t = the real output gap;

A_t = future inflation expectation;

P_t = prices.

equals the price equation of the St. Louis model. Nevertheless, the interpretation of the coefficients will be different. See Queiroz, 1978.

5.1 — The model for Brazil

The model used in this study was developed by the Federal Reserve Bank of St. Louis. The original model was slightly modified, however it conserves the recursivity that facilitated the use of the ordinary least square technique in the estimation process.

All of the variables were treated as first order logarithmic changes and with respect to the original model changes were made due to lack of quartely data for certain variables. These variables are the long and short-run interest rates and the rate of unemployment. Therefore, the equations which use these variables were not estimated.

The process of the formation of future inflation rate expectations is another question to be examined. In the St. Louis model, the coefficients of the long-run nominal interest rate equation are used in the construction of the expectation variable. Another expectation formation process had to be adopted due to the absence of this equation in the specification of the model. Consequently, in the expectation formation, we used Cagan's adaptive method. [16]

In the econometric part of this study, the procedure used was the construction of expected inflation rate series for different values of β. The value which maximizes the coefficient of determination of the estimated function was taken as the estimate of β. Thus, various β adjustment coefficient (0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0) were used to represent the future price expectation variable. [17]

Several hypothesis were raised regarding the adjustment velocity of the future inflation expectations. It may be proven that the estimate thus obtained is of maximum likelihood. [18]

[16] The model of adaptive expectations originates in the hypothesis that the economic agents correct their errors, period by period. Given that P is the rate of inflation, that the asterisk indicates the expected values, and the adjustment coefficient, we may formulate the following model:

$$P^* - P^*_{t-1} = \beta(P_{t-1} - P^*_{t-1}), \quad 0 < \beta > 1$$

$$P^* = P^*_{t-1} + \beta(P_{t-1} - P^*_{t-1})$$

If the observed inflation rate P_{t-1} is greater than the expected inflation rate P^*_{t-1}, the inflation expectation increases by the proportion β of the error $P_{t-1} - P^*_{t-1}$. In the opposite case, the inflation expectation decreases in the same proportion β as of the error. See Cagan, 1956.

[17] Adjustment coefficient less than 0.4 were not considered, since it was deemed *a priori* that, given the Brazilian inflationary experience, such a slow expectation adjustment velocity would be senseless.

[18] Pastore, 1969, p. 106.

The following equations constitute the model for the Brazilian economy:

$$DLog\ Y_t = a_o + \sum_{i=0}^{n} mi\ DLog\ M_{t-1} \quad (12)$$

$$D_t = DLog\ Y_t - (Log\ X_t^F - Log\ X_{t-1}) \quad (13)$$

$$DLog\ P_t = a_1 + \sum_{i=0}^{n} di\ D_{t-i} + C_1\ A_t \quad (14)$$

$$A_t = \sum_{i=0}^{n} \beta(1-\beta)^i\ DLog\ P_{t-1-i} \quad (15)$$

$$DLog\ Y_t = DLog\ X_t + DLog\ P_t \quad (16)$$

Where:

Y = nominal expenditure;
M = money;
X^F = potential output;
X = real output;
P = prices;
A = expectation of future inflation;
D = demand pressure.

Equation (14) was estimated with the Almon technique.[19] A specification with a second degree polinomial was used, with lags distributed over time of 2, 4, 6, and 8 periods. Since we are working with small sample periods, we used the polinomial lag technique in order to decrease the number of parameters to be estimated.[20]

The difficulty in using the polinomial lag model is that the polinomial degree and the extension of the lags must be specified *a priori*. The criterion used in the choice of alternative specifications was the magnitue of $\bar{R}^2$. Therefore, in this study, the specifications which produce larger $\bar{R}^2$ are considered to be preferable in relation to the others which produce higher residual variance or lower $\bar{R}^2$.[21]

19 Almon, 1965, p. 178-196.

20 Kelejian and Oates, 1974, p. 156.

21 In the ordinary least square estimate, the addition of an independent variable normally decreases the sum of the square of the residuals. Another statistic, the residual variance, must be computed in order to make the comparison among the equations with the same dependent variable, but with different independent variables. The $\bar{R}^2$ statistic may decrease with the addition of a variable to the equation, even when R^2 increases. This is possible if the variance of Y is not affected by the independent variables. See Rao and Miller, 1971, p. 18-21.

5.2 — Sample periods

Two sample periods were considered:

1. From the second quarter of 1957 (57.2) to the fourth quarter of 1964 (64.4).
2. From the second quarter of 1969 (69.2) to the fourth quarter of 1976 (76.4).

Both periods have 31 observations. This division was made since the period 57.2 to 64.4 is representative of an institutional period characterized by the absence of monetary correction, and the period 69.2 to 76.4 representative of generalized use of indexation in the Brazilian economy. The period 65.1 to 69.1 was not considered, first because it was a transitional period from the indexed to the non-indexed system and second, so as to establish a lag system in the second period which does not use data from the first period.

5.3 — The price equation

The test of the hypothesis (i.e., that in an indexed system the conflict between inflation and unemployment is mitigated) is developed on a price equation.

In the comparison between the two different periods, it is expected that the coefficient of the future inflation expectation variable is higher in the period without monetary inflation in relation to the other. This means that in the first period, the economic agents are forming price expectations which influences future prices. In the second period, with monetary correction, the coefficient of the future inflation expectation variable should be less, indicating that in this period, the economic agents are protected against inflation to the point of not being concerned with forming expectations. These, logically, do not enter into the formation of prices, hence the lower coefficient.

5.3.1 — Preliminary results

The price equation of our model is a follows. [22]

$$DLog\ P_t = a + \sum_{i=0}^{n} di\ D_{t-i} + C_1\ A_t \qquad (17)$$

[22] In the econometric study, seasonal dummies are used.

where:

P = price index;

D = demand pressure, defined as follows:

$$D = D\text{Log } Y_t - (\text{Log } X_t^F - \text{Log } X_{t-1})$$

A = future inflation expectation, constructed according to:

$$A_t = \sum_{i=0}^{n} (1 - \beta)^i \, D\text{Log } P_{t-1-i}$$

where β is a coefficient which represents the adjustment velocity of past inflation expectations.

Before presenting the results of the estimate of this complete equation, we shall present the estimate carried out without the demand pressure variable (D). The objective of this first exercise is to obtain information on the behavior of the coefficient of the future inflation expectation variable in the price formation process. The results appear in Tables 1 and 2.

The regressions were made by using the ordinary least squares technique and indicate the logaritmic variation of the price index as a function of the inflation expectation A for the following values of β: 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.975. The values in parenthesis are the t statistic. $\bar{R}^2$ is the determination coefficient, adjusted by degrees of freedom. *SE* is the standard error. *DW* is the Durbin Watson statistic. *DF* means degree of freedom and β is the coefficient of the future inflation expectation adjustment.

The results show that in all cases, the estimated coefficient of variable A is significantly different from zero at the 95% level. These initial estimates are not capable of indentifying the best value of the coefficient of expectation adjustment for each period. This is due to the fact that in our results for the period 57.2-64.4, the $\bar{R}^2$'s vary between 0.45 and 0.49 for the different values of β, as may be observed in Table 1. It may be observed in Table 2 that for the period 69.2-76.4, the same occurs and the $\bar{R}^2$'s take on the value 0.18 for the various hypothesis regarding the value of β. Therefore, it may not be concluded that for the indexed period (69.2-76.4) the expected inflation adjustment velocity has increased in relation to the non-indexed period, since it is not possible to identify the best β value for each period, as was estimated.

With regard to the behavior of the coefficient of the expectation variable, for each value of β the c coefficient is always higher for

the non-indexed period (57.2-64.4). This means that the elasticity of the future inflation rate is always higher for the non-indexed period, for any hypothesis made regarding the velocity of the expectation adjustment (represented here by value β).

It may be affirmed that the coefficient of the future inflation expectation variable is greater for the period 57.2-64.4, in relation to the behavior of the c coefficient in the two periods. However, the appropriate test must be conducted in order to know if it is statistically greater. This test will be conducted at the end of this section.

In Table 3, we reproduced the best estimates of the St. Louis model price equation made with the second degree polinomial for the different values of β for both periods. The values in parenthesis are the t statistic. $\overline{R}^2$ is the determination coefficient adjusted by degrees of freedom. *SE* is the standard error. *DW* is the Durbin Watson statistic. *DF* means degrees of freedom and the values in parenthesis after A_t is the coefficient of future inflation expectation adjustment β.

The comparison of the econometric results between the two periods shows that the lag of the demand pressure variable is greater for the indexed period. It seems that indexation tends to increase the lag as demand pressure (and therefore, monetary policy) affects prices. The coefficient of the price expectation variable is systematically higher for the non-indexed period (57-2-64.4).

With regard to the β coefficient of the price expectation variable adjustment, the value of $\overline{R}^2$ increases slightly as the value of β increases in both periods and without monetary correction. Such behavior does not suggest that there was an acceleration of expectation adjustment in the indexed period.

The traditional Phillips curve,

$$D\text{Log } P_t = \gamma - \theta H_t + \alpha A_t \qquad (18)$$

where:

P = price index;
H = real output gap;
A = expected inflation rate,

equal the price equation of the St. Louis model,

$$D\text{Log } P_t = a + d D_t + c A_t \qquad (19)$$

Table 1

Price Equation

Period 57.2 – 64.4

$$DLog\ P_t = a + d_1D_1 + d_2D_2 + d_3D_3 + c\ A_t$$

$$A_t = \sum_{i=0}^{n} \beta(1-\beta)^i\ DLog\ P_{t-i-4}$$

	$\beta=0,4\ n=13$	$\beta=0,5\ n=9$	$\beta=0,6\ n=8$	$\beta=0,7\ n=5$	$\beta=0,8\ n=4$	$\beta=0,9\ n=3$	$\beta=0,975\ n=2$
C_t	0,8727 (4,8991)	0,8294 (4,9425)	0,7943 (4,9555)	0,7624 (4,9215)	0,7302 (4,8346)	0,6955 (4,6872)	0,6667 (4,5375)
a	0,0482 (2,3740)	0,0519 (2,6459)	0,0551 (2,8761)	0,0579 (3,0668)	0,0603 (3,2077)	0,0625 (3,3067)	0,0641 (3,3571)
D_1	−0,0198 (−0,9467)	−0,0231 (−1,1048)	−0,0262 (−1,2523)	−0,0291 (−1,3788)	−0,0314 (−1,4685)	−0,0329 (−1,5119)	−0,0334 (−1,5098)
D_2	−0,0641 (−3,1628)	−0,0667 (−3,2946)	−0,0686 (−3,3834)	−0,0696 (−3,4180)	−0,0696 (−3,3884)	−0,0685 (−2,2033)	−0,0671 (−3,1825)
D_3	−0,0353 (−1,7501)	−0,0347 (−1,7259)	−0,0335 (−1,6668)	−0,0317 (−1,5695)	−0,0293 (−1,4379)	−0,0266 (−1,2814)	−0,0244 (−1,1572)
R^2	0,49	0,49	0,49	0,49	0,48	0,47	0,45
EP	0,04	0,04	0,04	0,04	0,04	0,04	0,04
DW	1,80	1,93	2,06	2,18	2,29	2,37	2,41
DF	26	26	26	26	26	26	26

Table 2

Price Equation

Period 69.2 – 76.4

$$DLog\ P_t = a + d_1D_1 + d_2D_2 + d_3D_3 + c\ A_t$$

$$A_t = \sum_{i=0}^{n} \beta(1-\beta)^i\ DLog\ P_{t-1-i}$$

	$\beta=0,4\ n=13$	$\beta=0,5\ n=9$	$\beta=0,6\ n=8$	$\beta=0,7\ n=5$	$\beta=0,8\ n=4$	$\beta=0,9\ n=3$	$\beta=0,975\ n=2$
C_t	0,8596 (3,2015)	0,7653 (3,1893)	0,6981 (3,1833)	0,6364 (1,1817)	0,6042 (3,1830)	0,5683 (3,1848)	0,5444 (3,1867)
a	0,0036 (0,2133)	0,0080 (0,5119)	0,0112 (0,7538)	0,0137 (0,9674)	0,0158 (1,1598)	0,0177 (1,3443)	0,0190 (1,4797)
D_1	0,0086 (0,7366)	0,0080 (0,7494)	0,0089 (0,7639)	0,0091 (0,7775)	0,0092 (0,7887)	0,0093 (0,7964)	0,0094 (0,7992)
D_2	0,0106 (0,9435)	0,0180 (0,9551)	0,0108 (0,9604)	0,0108 (0,9596)	0,0107 (0,9515)	0,0105 (0,9356)	0,0103 (0,9189)
D_3	0,0102 (0,9109)	0,0101 (0,9045)	0,0100 (0,8937)	0,0098 (0,8785)	0,0096 (0,8598)	0,0094 (0,8378)	0,0092 (0,8201)
R^2	0,18	0,18	0,18	0,18	0,18	0,18	0,18
EP	0,02	0,02	0,02	0,02	0,02	0,02	0,02
DW	1,80	1,85	1,90	1,94	1,98	2,01	2,04
DF	26	26	26	26	26	26	26

Table 3

Period 57.2/64.4	Period 69.2/76.4
$D \text{ Log } P_t = 0{,}0114 + 0{,}2112 \sum_{i=0}^{3} D_{t-i} + 0{,}0703\ A_t$	$D \text{ Log } P_t = 0{,}0352 + 0{,}2120 \sum_{i=0}^{8} D_{t-i} + 0{,}3781\ A_t$
(0,5764) (2,6580) (3,7810) $\beta = 0{,}4$	(1,5330) (2,3278) (1,0605) $\beta = 0{,}4$
$R^2 = 0{,}07$ $DW = 1{,}45$	$R^2 = 0{,}27$ $DW = 1{,}73$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0142 + 0{,}1968 \sum_{i=0}^{3} D_{t-i} + 0{,}0740\ A_t$	$D \text{ Log } P_t = 0{,}0366 + 0{,}2112 \sum_{i=0}^{8} D_{t-i} + 0{,}3488\ A_t$
(0,7435) (2,5103) (4,0670) $\beta = 0{,}5$	(1,7810) (2,3763) (1,1430) $\beta = 0{,}5$
$R^2 = 0{,}69$ $DW = 1{,}60$	$R^2 = 0{,}28$ $DW = 1{,}78$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0171 + 0{,}1830 \sum_{i=0}^{3} D_{t-i} + 0{,}0780\ A_t$	$D \text{ Log } P_t = 0{,}0374 + 0{,}2106 \sum_{i=0}^{8} D_{t-i} + 0{,}2304\ A_t$
(0,0274) (2,3710) (4,2890) $\beta = 0{,}6$	(1,9050) (2,4289) (1,2283) $\beta = 0{,}6$
$R^2 = 0{,}71$ $DW = 1{,}74$	$R^2 = 0{,}28$ $DW = 1{,}83$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0054 + 0{,}1730 \sum_{i=0}^{3} D_{t-i} + 0{,}0766\ A_t$	$D \text{ Log } P_t = 0{,}0380 + 0{,}2102 \sum_{i=0}^{8} D_{t-i} + 0{,}3105\ A_t$
(0,2091) (2,2560) (4,4478) $\beta = 0{,}7$	(2,1039) (2,4791) (1,3108) $\beta = 0{,}7$
$R^2 = 0{,}72$ $DW = 1{,}89$	$R^2 = 0{,}20$ $DW = 1{,}87$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0222 + 0{,}1670 \sum_{i=0}^{3} D_{t-i} + 0{,}0682\ A_t$	$D \text{ Log } P_t = 0{,}0380 + 0{,}2100 \sum_{i=0}^{8} D_{t-i} + 0{,}3048\ A_t$
(1,2420) (2,1877) (4,5338) $\beta = 0{,}8$	(2,3853) (2,5202) (1,3891) $\beta = 0{,}8$
$R^2 = 0{,}72$ $DW = 2{,}02$	$R^2 = 0{,}20$ $DW = 1{,}91$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0238 + 0{,}1668 \sum_{i=0}^{2} D_{t-i} + 0{,}0520\ A_t$	$D \text{ Log } P_t = 0{,}0301 + 0{,}2100 \sum_{i=0}^{8} D_{t-i} + 0{,}2944\ A_t$
(1,3341) (2,1755) (4,5518) $\beta = 0{,}9$	(2,5733) (2,5733) (1,4631) $\beta = 0{,}9$
$R^2 = 0{,}72$ $DW = 2{,}13$	$R^2 = 0{,}30$ $DW = 1{,}95$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$
$D \text{ Log } P_t = 0{,}0240 + 0{,}1703 \sum_{i=0}^{3} D_{t-i} + 0{,}0305\ A_t$	$D \text{ Log } P_t = 0{,}0396 + 0{,}2100 \sum_{i=0}^{8} D_{t-i} + 0{,}2850\ A_t$
(1,3736) (2,2198) (4,5061) $\beta = 1{,}0$	(2,7612) (2,6139) (1,5348) $\beta = 1{,}0$
$R^2 = 0{,}72$ $DW = 2{,}21$	$R^2 = 0{,}31$ $DW = 1{,}99$
$EP = 0{,}03$ $DF = 23$	$EP = 0{,}02$ $DF = 23$

where:

$$D_t = D\log Y_t - (\text{Log } X_t^F - \text{Log } X_{t-1})$$

Y = total expenditure;
X^F = potential output;
X = real output;

and the correspondence relations between the coefficients of the two formulations is as follows:

$$\gamma = \frac{a}{1-d}$$

$$\theta = \frac{d}{1-d}$$

$$\alpha = \frac{c}{1-d}$$

The objective of this econometric exercise is to analyze the short-run trade-off between inflation and unemployment. The test is based on the magnitude of $c + d$, c, d. Tables 4, 5 and 6 present these values for both the indexed and non-indexed periods, for the different hypothesis on β.

In order to guarantee complete absence of conflict between inflation and unemployment, we would have to find:

$$c + d = 1$$
$$c = 0$$
$$d = 1.$$

Since these results are not confirmed in either period, we cannot guarantee complete absence of the trade-off in the short-run for either the non-indexed nor the non-indexed period.

It may be observed in Table 4 that the value of $c + d$ for the period 57.2-64.4 is substantially higher (varying around 0.85) in comparison with the period 69.2-76.4 (which varies around 0.55). The magnitude of d does not vary much between the two periods, as indicated in Table 6. Observe in Table 5 that the magnitude of c (which varied between 0.63 and 0.68 during the period 57.2-64.4) shows a significant decrease during the period 69.2-76.4, varying between 0.28 and 0.38.

Table 4

Magnitude of $c + d$

β	Period 57.2/64.4 Non-Indexed	Period 69.2/76.4 Indexed
0,4	0,88	0,59
0,5	0,87	0,56
0,6	0,86	0,54
0,7	0,85	0,53
0,8	0,84	0,51
0,9	0,82	0,50
1,0	0,80	0,49

Table 5

Magnitude of c

β	Period 57.2/64.4 Non-Indexed	Period 69.2/76.4 Indexed
0,4	0,67	0,38
0,5	0,67	0,35
0,6	0,68	0,33
0,7	0,68	0,31
0,8	0,67	0,30
0,9	0,65	0,29
1,0	0,63	0,28

Table 6

Magnitude of d

β	Period 57.2/64.4 Non-Indexed	Period 69.2/76.4 Indexed
0,4	0,21	0,21
0,5	0,20	0,21
0,6	0,18	0,21
0,7	0,17	0,21
0,8	0,16	0,21
0,9	0,17	0,21
1,0	0,17	0,21

This information seems to indicate that there was an improvement in the sense that the elasticity of price variations in relation to variations in money have increased, although we may not affirm that during the indexed period, the short-run trade-off ceased to exist. In other words, monetary policy affected prices more than output in the short-run. The interpretation of these results is based on the hypothesis that the effect of monetary correction in nominal contracts is the fact that the economic agents cease to be concerned with the distributive effects of unexpected variations in the inflation rate. Thus, neither borrowers nor creditors are unforeseeably harmed or benefited, since contracts are drawn-up in real terms. Therefore, they do not need to form expectations upon making the contracts. Hence the value of c should approximate zero, indicating that the expectations do not influence the formation of prices.

5.3.2 — Complete specification — Another comparison

The existence of different lags for the pressure demand variable D_t was indicated by the use of the criteria for the choice of the best equation for each period, based on value R^2. The sample 57.2-64.4 presented a lag of two periods as the best and the sample of 69.2-76.4 presented a lag of eight periods.

The analysis and conclusions of the previous item are therefore based on the comparison of the same equation, although with different specifications. We shall now present Table 7, 8, and 9 listing the values of $c + d$, c and d for the two sample periods, with identical specifications of the price equation.

With regard to the specification of the price equation, with a lag of eight periods for the demand pressure variable, the magnitude of $c + d$ remains constant in the two periods and differs considerably from 1. In reference to the value of c, the opposite occurs, in other words, this value increases significantly during the period 69.2-76.4. The value of d decreases for the same period. This information leads us to the opposite conclusion, since $c + d$ takes on a fairly small value for the indexed period, c increases and d decreases. There would thus be a worsening in the short-run trade-off between inflation and unemployment.

In reference to the specification of the price equation with a lag of two periods for the pressure demand variable, the magnitude remains unaltered in both samples. The value of c practically does not change and the value of d decreases considerably. Nor was there

Table 7

Magnitude of $c + d$

β	Period 57.2/64.4 Non-Indexed		Period 69.2/76.4 Indexed	
	$n=8$	$n=2$	$n=8$	$n=2$
0-4	0,59	0,88	0,59	0,89
0,5	0,60	0,87	0,55	0,80
0,6	0,60	0,86	0,54	0,75
0,7	0,61	0,84	0,53	0,70
0,8	0,61	0,84	0,51	0,67
0,9	0,60	0,82	0,50	0,64
1,0	0,59	0,80	0,49	0,62

Table 8

Magnitude of c

β	Period 57.2/64.4 Non-Indexed		Period 69.2/76.4 Indexed	
	$n=8$	$n=2$	$n=8$	$n=2$
0.4	0,4	0,67	0,37	0,79
0,5	0,06	0,67	0,34	0,71
0,6	0,07	0,68	0,33	0,65
0,7	0,08	0,67	0,32	0,61
0,8	0,08	0,67	0,30	0,57
0,9	0,07	0,65	0,29	0,54
1,0	0,05	0,63	0,29	0.51

evidence here in favor of an improvement in the trade-off in the short-run for the period 69.2-76.4, since c did not vary and d decreased.

This said, we shall move on to the next two sections in search of additional evidence for the conclusion that the trade-off in the short-run improved during the period 69.2-76.4 in comparison with the period 57.2-64.4.

Table 9

Magnitude of d

β	Period 57.2/64.4 Non-Indexed		Period 69.2/76.4 Indexed	
	$n=8$	$n=2$	$n=8$	$n=2$
0,4	0,55	0,21	0,21	0,10
0,5	0,53	0,20	0,21	0,09
0,6	0,53	0,18	0,21	0,10
0,7	0,53	0,17	0,21	0,09
0,8	0,53	0,17	0,21	0,10
0,9	0,53	0,17	0,21	0,10
1,0	0,54	0,17	0,21	0,10

5.3.3 — An alternative specification of the price equation

The results of the regressions made for the price equation with the polinomial distribution show that the elasticity of the inflation rate in relation to the inflation expectation is systematically higher for the non-indexed period, in comparison with that obtained for the indexed period. This result is in full agreement with the interpretations of the Friedman hypothesis regarding the effects of monetary correction on the short-run conflict between inflation and unemployment. Although the test which we are about to conduct does not involve considerations on the lag between the demand pressure variable (D) and the inflation rate, it is understood that the extension of this lag provides us with some information on the conflict between inflation and unemployment.

According to the model used, the smaller the lag, the more rapidly the monetary policy adopted is transmitted to prices. Furthemore, if the prices become more sensible to the variation in the monetary rate of growth, less of this variation will be transmitted to the real output. Therefore, a longer lag structure seems to be incompatible with the hypothesis of less conflict.

The results obtained with the specification of the price equation, using the polinomial distribution, indicate that the lag structure is always greater during the indexed period than during the non-indexed period.

In attempting to confirm these results, we worked with an alternative specification, which will be explained below. However, in order to justify it, we considered the following problem: if we

wished to explain the variation of dependent variable Y_t with lagged variable X_{t-1}, together with other free variables, the change X_{t-i} is considered to exercize an effect on variable Y_t after a given number of periods. The regression equation can be specified as follows:

$$Y_t = a_o + a_1 X_{t-i} + a_2 Z_t + \xi_t$$

The lag of the independent variable X_{t-i} (which explains the dependent variable Y_t) may be obtained by estimating the equation for various values of i and by considering the lag which produces greater $\bar{R}^2$ as empirically appropriate. [23]

Following this model of *punctual* lags, the specification of the price equation would be:

$$D\text{Log } P_t = a + dD_{t-i} + cA_t \quad (\beta)$$

where:

P = price index
D = demand pressure
A = future inflation expectation
β = coefficient of the expectation adjustment

In Table 10, we list the estimates obtained for the various hyphotesis regarding the coefficient of expectation adjustment β, for both periods.

The results obtained with this specification ratify those generated by the equations estimated with polinomial lags. The magnitude of the coefficient of the price expectation variable A_t is systematically higher during the non-indexed period. This is confirmed for all of the hypothesis regarding the adjustment volocity β. With regard to the lag between the demand pressure variable and the inflation rate, the same type of information is produced. It is indicated that this lag was expanded during the indexed period.

Information on the size of the lag between the inflation rate and the demand pressure variable indicates that the variations in the growth of money supply take more time to affect prices during the indexed period than during the non-indexed period.

This results contradicts Friedman's theory on indexation. However, a more accurate examination of the role of indexation in the economic system explains this empirical result. In the

23 Rao and Miller, 1971.

Table 10

Period 57.2/61.4		Period 09.2/70.4	
$D \text{ Log } P_t = \underset{(0,3073)}{0,0061} + \underset{(3,7728)}{0,2343}\ D_t + \underset{(4,0240)}{0,6360}\ A_t$	$\beta = 0,4$	$D \text{ Log } P_t = \underset{(1,5722)}{0,0278} + \underset{(2,0514)}{0,1631}\ D_{t-8} + \underset{(1,0747)}{0,4728}\ A_t$	$\beta = 0,4$
$R^{-2} = 0,66$ $DW = 1,56$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,31$ $DW = 1,75$ $EP = 0,02$ $DF = 25$	
$D \text{ Log } P_t = \underset{(0,4252)}{0,0083} + \underset{(3,8377)}{0,2350}\ D_t + \underset{(4,1321)}{0,6091}\ A_t$	$\beta = 0,5$	$D \text{ Log } P_t = \underset{(1,831\ )}{0,0206} + \underset{(2,7238)}{0,1041}\ D_{t-8} + \underset{(1,7515)}{0,4328}\ A_t$	$\beta = 0,5$
$R^{-2} = 0,67$ $DW = 1,69$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,34$ $DW = 1,80$ $EP = 0,02$ $DF = 25$	
$D \text{ Log } P_t = \underset{(0,5190)}{0,0100} + \underset{(3,8424)}{0,2318}\ D_t + \underset{(4,1407)}{0,5830}\ A_t$	$\beta = 0,6$	$D \text{ Log } P_t = \underset{(2,0575)}{0,0308} + \underset{(2,7832)}{0,1041}\ D_{t-8} + \underset{(1,8223)}{0,4046}\ A_t$	$\beta = 0,6$
$R^{-2} = 0,67$ $DW = 1,81$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,35$ $DW = 1,85$ $EP = 0,02$ $DS = 25$	
$D \text{ Log } P_t = \underset{(0,6602)}{0,0127} + \underset{(3,8232)}{0,2351}\ D_t + \underset{(4,0068)}{0,5580}\ A_t$	$\beta = 0,7$	$D \text{ Log } P_t = \underset{(2,2370)}{0,0318} + \underset{(2,8317)}{0,1057}\ D_{t-8} + \underset{(1,8877)}{0,3828}\ A_t$	$\beta = 0,7$
$R^{-2} = 0,67$ $DW = 1,90$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,37$ $DW = 1,89$ $EP = 0,02$ $DF = 25$	
$D \text{ Log } P_t = \underset{(0,7452)}{0,0145} + \underset{(3,7968)}{0,2362}\ D_t + \underset{(3,9838)}{0,5314}\ A_t$	$\beta = 0,8$	$D \text{ Log } P_t = \underset{(2,4106)}{0,0327} + \underset{(2,8704)}{0,1063}\ D_{t-8} + \underset{(1,9470)}{0,3646}\ A_t$	$\beta = 0,8$
$R^{-2} = 0,66$ $DW = 1,97$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,36$ $DW = 1,94$ $EP = 0,02$ $DF = 25$	
$D \text{ Log } P_t = \underset{(0,8009)}{0,0158} + \underset{(3,7814)}{0,2390}\ D_t + \underset{(3,8198)}{0,5011}\ A_t$	$\beta = 0,9$	$D \text{ Log } P_t = \underset{(2,0203)}{0,0335} + \underset{(2,9201)}{0,1069}\ D_{t-8} + \underset{(2,0011)}{0,3486}\ A_t$	$\beta = 0,9$
$R^{-2} = 0,05$ $DW = 2,01$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,37$ $DW = 1,97$ $EP = 0,02$ $DF = 25$	
$D \text{ Log } P_t = \underset{(0,8203)}{0,0167} + \underset{(3,7812)}{0,2435}\ D_t + \underset{(3,9118)}{0,4668}\ A_t$	$\beta = 1,0$	$D \text{ Log } P_t = \underset{(2,7991)}{0,0343} + \underset{(2,9576)}{0,1074}\ D_{t-8} + \underset{(2,0513)}{0,3342}\ A_t$	$\beta = 0,1$
$R^{-2} = 0,63$ $DW = 2,01$ $EP = 0,03$ $DF = 25$		$R^{-2} = 0,37$ $DW = 2,00$ $EP = 0,02$ $DF = 25$	

monetarist approach, changes in the money supply determine the variations in total spending. These changes are subsequently allocated among variations in real output and prices. Thus, the behavior of an isolated market has no effect on the general price level, affecting only relative prices. Monetary correction isolated the real sector of the economy from purely monetary variations.

The question of indexation becomes more difficult, due to the effect of changes in relative prices on the price level and the difficulty in measuring mere monetary variations. Therefore, changes in the relative price structure may affect the calculation of the price index, in other words, the monetary correction index would be affected not only by purely monetary variations, but also by real changes.

Thus, although the use of monetary correction makes price formation less dependent on inflation expectations, distortions in an indexed economy may occur, widening the lag between the variations in money supply and inflation, as the price index varies with changes on the real side.

While indexation isolates the real sector from the effects of monetary shocks, it may exacerbate the effects of real shocks. This fact is not taken into consideration by authors such as Friedman, who focus only upon monetary disturbances. For an economy subject to both types of disturbances, this approach is set against the usual remedy of complete indexation as the cure for uncertainty. On the contrary, this analysis suggests an optimum degree of partial indexation which will depend on the statistic structure of the economy. The incentive for indexing would be relation to the variability of the price level and not with the average rate of change. [21]

In synthesis, the results, both in the specification of the price equation with Almon lags and in the specification with ordinary least squares indicate that:

1. The economic agents use less future inflation expectation in the process of determining the current inflation rate during the indexed period than in the non-indexed period. This effect tests the hypothesis that, even in the short-run, there is no conflict between inflation and unemployment in a fully indexed economy. In other words, it is senseless to speak of an absence of long-run conflict, since there exists no conflict, even in the short-run.

2. A greater lag between demand pressure generated by monetary policy (expansion or retraction of the rate of growth of money supply) and the inflation rate is created

[21] Gray, J. A., 1976, p. 221-236.

during the indexed period. This effect confirms the fact that indexation according to a given index can provoke distortions in the relative prices which may obstruct the mechanisms of economic policy transmission, since the price indices capture not only variations from the real sector with random characteristics.

5.3.4 — The test of structural change

Estimates have been made for two distinct sample periods (that of 57.2 to 64.4, and that of 69.2 to 76.4) with the objective of making comparisons between the indexed and non-indexed period. Thus, the following information was generated:

1. With regard to the demand pressure variable:

a) the lag between the demand pressure variable and the inflation rate is larger for the indexed period;

b) the magnitude of the coefficient of the demand pressure variable is practically the same for both periods.

2. With regard to the inflation expectation variable:

a) the results obtained do not enhance the distinction between the various alternatives of β adjustment coefficients attempted;

b) the magnitude of the coefficient of the future inflation expectation variable is always higher for the non-indexed period.

As mentioned in Section 1, the two effects of monetary correction on the price formation process would be: an effect that would make the short-run Phillips curve more vertical, and another effect which would make the process of adjustment between the expected inflation rate and the observed inflation rate more rapid, over time. In other words, this would be a more rapid adjustment of the short-run Phillips curve to the long-run position.

We have sought empirical support for the two possible effects of monetary correction on the price formation process. The size of the lags, of both the future inflation expectation variable and the demand pressure variable would be connected to the effect which would make the adjustment of the short-run Phillips curve to the long-run position more rapid and the magnitude of the coefficients of these variables to the effect that would make the short-run Phillips curve vertical.

With regard to the change in the size of the lags, nothing may be concluded in relation to future inflation expectation variable, but with relation to the demand pressure variable, the lag increased just for the indexed period. The interpretation of this result was presented previously in this section.

In reference to the magnitude of the coefficients, all that may be said until now is that the coefficient of the inflation expectation variable is less for the indexed period. Nevertheless, this information is purely numerical, and must be better qualified with a statistical test. In this section, we shall be concerned with the application of such a test. We shall now attempt to demonstrate that the coefficients are not only numerically different between the two periods, but that they are also statistically different.

Since we were previously concerned with the size of the lags, we worked with polinomial distribution, ordinary least squares with lags and adaptive expectation formations. Actually, the use of different specifications for the price equation, in terms of different behavioral hypothesis regarding lags, makes it unnecessary to compare the magnitude of the coefficients of the various variables between the two periods. For this reason, we shall use the same specification in this section, in terms of lags for both periods and for both variables, since we are solely concerned with the magnitude of the coefficients.

The St. Louis model price equation differs from the traditional version of the Phillips curve in that it includes the demand pressure variable in its specification rather than the real output gap. The objective of this modification is to make the model recursive. Nevertheless, both versions of the price equation are equivalent. The interpretation of the coefficients of the explanatory variables is that it is different.

Since the St. Louis model price equation has already been estimated, and since it is given that the traditional Phillips curve and the St. Louis model price equation, presented here, are equivalent, we will develop a test of structural change with the specification of the traditional Phillips curve.

Our price equation for the test will have the following specification:

$$D\text{Log } P_t = \gamma + \sum_{i=1}^{n} \theta_i H_{t-1-i} + \sum_{i=0}^{n} \alpha_i D\text{Log } P_{t-1-i}$$

where:

P = general price index;

H = real output gap, defined as:

$$H_t = \text{Log } X_t^F - \text{Log } X_t$$

X^F = potential output;

X = real output.

Another modification introduced in this section is the formation of the inflation expectation variable, for which we did not use the adaptive method. The influence on prices of both the real output gap and past prices are now measured with distributed polinomial lags.

The test consists of the estimation of the price equation, using data from both periods under consideration. The estimation of the same equation is then made for the same period, although separative dummies for the indexed period are used.

Since we are attempting to examine the difference between the coefficients of the future inflation expectation variable and not the difference in the size of the lags, the same lag was used for both the expectation variable and the gap variable. The two equations to be estimated have the following specification:

$$D\text{Log } P_t = \gamma + \sum_{i=0}^{n} \theta_i H_{t-1-i} + \sum_{i=0}^{n} \alpha_i D\text{Log } P_{t-1-i}$$

$$D\text{Log } P_t = \gamma + D_1 + \sum_{i=0}^{n} \theta_i H_{t-1-i} + \sum_{i=0}^{n} \theta_i^1 D_1 H_{t-1-i} + \\ + \sum_{i=0} \alpha_i D\text{Log } P_{t-1-i} + \sum_{i=0} \alpha_i^1 D_i D\text{Log } P_{t-1-i}$$

where:

H = the output gap, defined as:

$$H_t = \text{Log } X_t^F - \text{Log } X_{t-1},$$

where X^F is the potential output and X is the real output;

P = the general price index;

D_1 = 0 from 57.2 to 64.4;

= 1 from 69.2 to 76.4.

Tables 11 and 12 present the results.

It will be observed that this result confirms the previous one, i.e. the coefficient of the future inflation expectation variable is lower for the period 69.2-76.4 (the indexed period).

The variance analysis treatment may be extended to test the contribution for the explanation of the variance of the dependent variable (in the case of the inflation rate) by a subgroup of independent variables (in the case of the separatist dummies together). The test of the hypothesis that the coefficients of the additional variables (dummies) are null together is conducted by computing the following ratio which has an F distribution with $(k - r, n - k)$ degree of freedom.[25]

$$F = \frac{\dfrac{\sum_{i=r+1}^{k} \hat{\beta}_i^{*2}}{k - r}}{\dfrac{\sum_{i=1}^{n} e_i^2}{n - k}}$$

where:

$\sum_{i=r+1}^{k} \hat{\beta}_i^{*2}$ is the difference between the variance of the inflation rate in the regression without dummies and the variance of inflation in the regression with dummies;

$k - r$ is the number of dummies which were used. K is the number of variables in the regression with dummies, and r is the number of variables in the regression without dummies;

$\sum_{i=1}^{n} e_i^2$ is the variance of the error of the regression with dummies;

$(n - k)$ are the degrees of freedom of the regression with dummies.

Thus, our F will be:

$$F = \frac{\dfrac{0{,}0409319}{3}}{\dfrac{0{,}045692}{45}} = 13{,}45$$

The critical F is

$$F(3.45) = 2.86$$

Therefore, the dummies together are significant. It may now be affirmed that, besides being numerically different, the coefficients

[25] Johnston, 1972, p. 143-146.

Table 11

Price Equation
Period 57.2-64.4 69.2-76.4
Almon Lags — Second Degree
Without Restrictions

$$D\text{Log}P_t = 0{,}0357 + \sum_{i=0}^{8} \theta_i H_{t-1-i} + \sum_{i=1}^{8} \alpha\, D\,\text{Log}\, P_{t-1-i}$$

θ_{t-1}	= 0,0176	(0,5288)	α_{t-1} = 0,2136	(2,1610)
θ_{t-2}	= −0,0085	(−0,5309)	α_{t-2} = 0,1068	(1,9040)
θ_{t-3}	= −0,0265	(−2,1290)	α_{t-3} = 0,0360	(0,7388)
θ_{t-4}	= −0,0366	(−2,1980)	α_{t-4} = 0,0011	(0,0202)
θ_{t-5}	= −0,0387	(−2,1150)	α_{t-5} = 0,0022	(0,0414)
θ_{t-6}	= −0,0328	(−1,9410)	α_{t-6} = 0,0393	(0,8705)
θ_{t-7}	= −0,0189	(−1,0380)	α_{t-7} = 0,1123	(2,0170)
θ_{t-8}	= −0,0029	(−0,0029)	α_{t-8} = 0,2213	(2,1310)
$\Sigma\theta_i$	= −0,1416	(−2,4082)	$\Sigma\alpha_i$ = 0,7325	(3,6226)
DM	= 4,12		DM = 3,56	
R^2	= 0,59		F = (9,52) = 8,23	
EP	= 0,03		DF = 52	
DW	= 1,96		SSR = 0,0558	

of the free variables are also statistically different between the indexed and the non-indexed periods.[26]

This test has confirmed that the coefficient of the future inflation expectation variable is less for the indexed period. Thus, the price equation for the non-indexed period would be:

$$D\text{Log}\, P_t = 0{,}0050 - 0{,}5857 \sum_{i=1}^{8} H_{t-1-i} + 0{,}5185 \sum_{i=1}^{8} D\text{Log}\, P_{t-1-i}$$

and for the indexed period:

$$D\text{Log}\, P_t = 0{,}0800 - 0{,}2914 \sum_{i=1}^{8} H_{t-1-i} + 0{,}1300 \sum_{i=1}^{8} D\text{Log}\, P_{t-1-i}$$

These results do indicate that the coefficient of the future inflation expectation variable is less for the indexed period.

[26] It is important to note that the price equation specifications utilized for this statistical test are the same. The objective of the estimates made, besides the possibility of conducting the statistical test, is to compare the magnitude of c_1 in the two periods, for the same specification of the price equation.

Nevertheless, this is not sufficient to affirm that for the indexed period, the effects of monetary policy have become completely neutral in the short-run. If the share of the inflation expectation in the price formation process decreased, the share of the real output gap (which, in this specification, substituted the St. Louis model demand pressure variable) also decreased.

It was previously seen that the lag between the demand pressure variable and the inflation rate has widened for the period with monetary correction; it is now seen that the magnitude of this effect decreased. This fact proves the importance of the selection of an index for the correction of nominal contracts. The optimum index would be that which reflects only monetary changes having occured in the economy, and not real changes; and purged index. The search for such an index is motive for additional research.

Table 12

Price Equation
Period 57.2-64.4 69.2-76.4
Almon Lags — Second Degree
Without Restrictions

$$D\text{Log}P_t = \underset{(0,2651)}{0,0050} + \underset{(2,3386)}{0,0764}\, D_4 + \sum_{i=1}^{8} \theta_i H_{t-1-i} + \sum_{i=1}^{8} \theta_i^1 D_4 H_{t-1-i} + \sum_{i=1}^{8} \alpha_i D\text{Log}P_{t-1-i} + \sum_{i=1}^{8} \alpha_i^1 D_4 D\text{Log}P_{t-1-i}$$

θ_{t-1}	= −0,0687	(−1,7360)	α_{t-1}	= 0,0378	(0,2917)
θ_{t-2}	= −0,0806	(−2,7240)	α_{t-2}	= 0,0079	(0,1099)
θ_{t-3}	= −0,0743	(−3,6740)	α_{t-3}	= 0,0031	(−0,0584)
θ_{t-4}	= −0,0698	(−3,4040)	α_{t-4}	= 0,0046	(0,0795)
θ_{t-5}	= −0,0673	(−0,0940)	α_{t-5}	= 0,0311	(0,5420)
θ_{t-6}	= −0,0665	(−0,0330)	α_{t-6}	= 0,0764	(1,5450)
θ_{t-7}	= −0,0677	(−2,5200)	α_{t-7}	= 0,1405	(2,3510)
θ_{t-8}	= −0,0707	(−1,6560)	α_{t-8}	= 0,2233	(1,9980)
$\Sigma\theta_i$	= −0,5857	(−3,4801)	$\Sigma\alpha_i$	= 0,5185	(2,3890)
θ_{t-1}^1	= 0,1275	(1,4660)	α_{t-1}^1	= −0,0030	(−0,0115)
θ_{t-2}^1	= 0,0882	(1,6800)	α_{t-2}^1	= −0,0109	(−0,0784)
θ_{t-3}^1	= 0,0555	(1,3840)	α_{t-3}^1	= −0,0214	(−0,1899)
θ_{t-4}^1	= 0,0295	(0,7340)	α_{t-4}^1	= −0,0345	(−0,2601)
θ_{t-5}^1	= 0,1011	(0,3840)	α_{t-5}^1	= −0,0502	(−0,3689)
θ_{t-6}^1	= −0,2613	(−0,0770)	α_{t-6}^1	= −0,0651	(−0,5708)
θ_{t-7}^1	= −0,0087	(−0,2070)	α_{t-7}^1	= −0,0894	(−0,6529)
θ_{t-8}^1	= −0,0081	(−0,1070)	α_{t-8}^1	= −0,1128	(−0,9186)
$\Sigma\theta_i^1$	= 0,2914	(1,25660)	$\Sigma\alpha_i^1$	= −0,3908	(−0,9186)

R^2 = 0,66 F (16,45) = 5,53
PE = 0,03 DF = 45

Our objective is to show that the monetary correction system may diminish the short-run adverse effects of restrictive monetary policy, however the correction should be made with the appropriate index, calculated only in function of monetary changes.

6 — Conclusions

The purpose of this study was to test Friedman's hypothesis that in an economic system with monetary correction the short-run conflict between inflation and unemployment is mitigated. This hypothesis was tested as applied to the case of the Brazilian economy.

The use of monetary correction in an economic system evokes a wide variety of questions, several of which are as follows:

1. Given that there is a progressively increasing opening of the Brazilian economy to foreign markets, the use of a model for an open economy could facilitate the study of the effect of monetary correction on the economy's external and internal equilibrium.
2. The introduction of monetary correction should create a change in the distribution of income and the economy's wealth.
3. More important than the previously mentioned problems is the choice of an index to be used for the correction of prices.

The purpose of this study is not, however, to broach all of the questions related to the implementation of monetary correction in a given economy. Our intention was to merely test Friedman's hypothesis, and for this reason, other important aspects of indexation were not examined.

In principle, two possible effects of indexation on the Phillips curve were considered:

1. The acceleration of the process of formation of future inflation expectations, if we consider this process to be a function of past inflation rates. This effect would be understood by the fact that economic agents are capable of adjusting their expectations more rapidly, when in possession of more information.
2. The generalized use of indexation clauses in nominal contracts makes the economic agents feel protected against the distributive effects of an unexpected variation in the

inflation rate an unexpected variation in the inflation rate and they therefore cease to utilize future inflation expectations in the short-run price formation process. This would be the equivalent of an absence of conflict between inflation and unemployment in a situation of complete indexation, even in the short-run. Therefore, there would be no adjustment to a long-run position, since there is a complete absence of monetary illusion.

The pioneer study by Phillips has fostered countless controversies on the trade-off between inflation and unemployment. These controversies have largely resulted in the consensus that, although the conflict exists in the short-run, it disappears in the long-run as the expected values converge on those actually observed.

Friedman argues, however, that monetary correction separates the real from the nominal side, and therefore monetary variations have a direct effect on prices without effecting real output even in the short-run. In other words, the money effect would be neutral, even in the short-run, with monetary correction.

In this study, we used the St. Louis model and data on the Brazilian economy which, in 1965, adopted the use of monetary correction. We separated two sample periods, the first corresponding to the pre-1965 period when monetary correction was not yet in use, and the post-1965 period, when contracts with correction clauses became generalized.

The St. Louis model price equation was then estimated for both periods. The results indicated that the economic agents use expectations of future inflation rates more during non-indexed periods. This conclusion is taken from the information obtained in the econometric exercise — information which indicates that the coefficient of the expectation variable is always less during the indexed period, as compared to the non-indexed period. This result prevails for the various specifications attempted in the price equation and for the various hypothesis on the adjustment of future inflation expectations. Furthermore, in many of the results obtained, the c coefficient of the inflation expectation variable is statistically different from zero for the non-indexed period, but it is not for the indexed period. This means that, according to these results, during the indexed period, the economic agents do not use inflation expectations in the process of current price formation.

There exist two possibles reasons for the fact that R^2 is lower for the indexed period:

1. The method of expectation formation used by the economic agents changed with the monetary correction system.

2. The effect of definitive price changes became more important in the economy than the effect of monetary changes.

In the first case, the change in the process of expectation formation may be caused by the fact that economic agents simply do not form any expectation. The second case not only explains the low value of $\bar{R}^2$, but also clarifies the widening of the lag for the demand pressure variable in the price equation.

Our results were inconclusive with regard to the hypothesis that monetary correction accelerated the process of expectation formation. We formulated the hypothesis that the expectations were formed in an adaptive manner in relation to the past inflation rates. Several alternatives were attempted concerning the adjustment velocity. The results obtained, however, were not sufficient to identify the real adjustments, therefore nothing may be affirmed in relation to this interpretation.

With regard to our first interpretation, our results indicate that although the short-run trade-off did not cease to exist, it diminished as the expectation of future inflation lost effect on the short-run price formation process, during the indexed period. The trade-off would only cease to exist completely if there had been a modification in the coefficient of the demand pressure variable diminishing the lags and increasing its share in the price formation process. In our tests, none of these events occured.

Since 1965, many institutional reforms have been made in the Brazilian economy. Although monetary correction may be considered as a basis for the majority of these reforms, it may not be affirmed that the introduction of an indexed system has been the only change. We may therefore state that there has been a behavioral change mitigating the short-run conflict between inflation and unemployment in the period during which the Brazilian economy was indexed.

Ever since monetary correction was introduced to the Brazilian institutional apparatus, much has been said about the role it plays in the acceleration of the inflationary process. This study seems to bring to evidence the fact that monetary correction, in fact, does not accelerate inflation. On the contrary, monetary correction becomes the strongest ally of anti-inflationary policy (total spending policy), as the economic agents cease to be preocupied with the distributive effects of an unexpected variation in the inflation rate. With indexation, public and private spending policy (the reflection of monetary and fiscal policy) have a more direct effect on the inflation rate, without affecting the real side of the economy. Thus, when the policy is expansionary, the effect on prices is felt sooner, than with contractionary policy.

Finally, it is worth noting that the central question involving monetary correction is the selection of the index to be used. Our study concluded that with monetary correction, the effects of the economy's total spending policy on prices would be more quickly registered. For this reason, many economists argue that monetary correction restimulates the inflationary process. Nevertheless, when real variations occur, they cannot participate in monetary correction, since this would risk the creation of obstacles to the realization of the objectives of indexation, i.e. the avoidance of the redistributive effects of inexpected inflation.

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The minimum wage and wage rates in Brazil *

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1 — Introduction

The analysis of an economy's *wage rate* is fundamental to understand not only certain aspects of the process of capital accumulation, but also the variations produced throughout this process in the parameters of income distribution. For this reason, studies on employment trends and income distribution must face the problem of measuring the "real wage" trend of an economy; in the case of the Brazilian economy, most of these studies have been limited to the analysis of industrial wages. If all the available data on industry's real wages were compatible or at least coherent, most of the debate on the economy's performance and its effects on the population's well-being would assuredly be more objective.

Until not long ago, analysis which confirm the appreciable growth of real wages in industry over the past few decades, were somewhat out of style. [1] However, in May of 1979, Mario Henrique Simonsen, then Minister of Planning, vested such interpretations with new relevance when, in addressing the Brazilian Federal Senate, he cited the conclusions of a study conducted by an economist of

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[1] J. Ramos, "An Heterodoxical Interpretation of the Employment Problem in Latin America", in *World Development*, vol. 2, no. 7 (July, 1974), pp. 47-58. and R. Webb, "Some Characteristics of Urban Labor Market Structure and Movement and on Urban Poverty in Latin America", presented at the Seminar on the Informal Urban Sector (Santiago: CLACSO, PREALC, June, 1977).

IPEA.[2] This study is based on average industrial wages, and does not take into account their increased degree of dispersion.

A substantial portion of Brazilian labor market analysts defend positions which differ from those mentioned above only with regard to the degree of the increase in real wages. Thus, they have argued that the minimum-wage trend (negative since the early 1960's and especially since 1964) does not represent that of the economy's base-wage, because the proportion of people who receive less than minimum wage, or slightly more, has decreased over time. Thus, the trend in industrial wages, though not as favorable as the average-wage figures suggest, has been more positive than assumed by the most ardent critics of the social aspects of the economy's performance. As a compromise solution, the median wage has been proposed as an alternative indicator for the measurement of this phenomenon.

This study seeks to systematize part of the various arguments which have been presented. It also attempts to show how, in the recent past, the wage rate of the urban capitalist economy in Brazil was essentially determined by minimum wage readjustment policy. As can easily be perceived, this fact contains implications which transcend the mere problem of determining the statistical series to be adopted in the analysis of wages in the Brazilian economy.

2 — Characterization of the wage rate

Before initiating the analysis of each position, it is essential to define the concepts of the issue in question. *Wage rate,* as we understand it, is the base-wage paid to unskilled labor within the capitalist nucleous of an economy. It is therefore, the wage in effect for an important part of the industrial labor force, including the employees of medium and large industry. It does not refer to wages paid by firms which have the option of complying or not complying with labor legislation, paying the legal wage.[3] Nor does it refer to earnings generated by the activities of the so-called "informal sector". In other words, it is the remuneration of "sim-

[2] "Real average wages paid in the manufacturing industry decreased from 1961 to 1968 but, with the acceleration of the development and demand for labor, began to recover significantly in 1968. On the average, real wages actually paid by the Manufacturing Industry increased by 4.5% from 1963 to 1977". See M. H. Simonsen, "A Inflação Brasileira e a Atual Política Anti-Inflacionária", a speech delivered to the Federal Senate on May 31, 1979 (Brasília: Secretaria de Planejamento da Presidência da República, 1979), p. 34, mimeo., and Carlos Von Doellinger, "Salário e Política Salarial" (Brasília: IPEA-IPLAN, 1979), mimeo.

[3] R. Macedo and M. E. Garcia, "Observações sobre a Política Brasileira de Salário Mínimo" (São Paulo: FIPE-USP, 1978), mimeo.

ple labor" employed by firms which, due to their size or organization, must necessarily comply with the law, paying at least the minimum wage to their unskilled workers.

The determination of the wage rate, as defined above, is crucial to understand the functioning of the economy as a whole for various reasons, to be explained below.

First, we must examine the ratio of the wage rate to the earnings received by other segments of unskilled labor force. Many "classical" or "Ricardian" interpretations maintain that it is the income from small-scale commercial production (rural or urban) which determines the base-wage of the economy. [4] Such positions are mere variations of the Lewis model and, among other things, assume a high degree of mobility in the labor market.

Although there undeniably exist relations among the incomes of all unskilled labor, we have taken the opposing position. As will be explained later on, in this study, the base-wage in the capitalist nucleus sets the guidelines for the wages received by the remainder of the unskilled labor force, including those employed in small businesses (such as self-employed or family workers). Our view is that the base-wage is determined internally within the capitalist nucleus, as we shall discuss later on. [5]

Second, wage distribution depends to a certain extent on the wage rate itself. Thus, sharp decreases in the wage rate tend to facilitate greater wage differentiation which appears to be a permanent trend in the development of capitalism in its monopolistic phase. Inversely, increases in the wage floor make this differentiation difficult. [6]

Third, the wage structure and wage rates are linked to the pattern of capital accumulation and the structure of production.

[4] In our opinion, such interpretations approximate the neoclassical more than classical or "Ricardian" thought.

[5] Opposing interpretations are made by Macedo and Garcia, *op. cit.*, and Edmar L. Bacha, ("The Real Wage in Southern Brazil from 1946 to 1977" (November, 1978), mimeo. In the first instance, the authors explicitly maintain the theory that income in urban small-scale commercial production (informal sector) is the determinant of the wage level of unskilled labor. Bacha, in turn, although he does not explicitly express a similar concept, relates wage level (rural and urban) to agricultural prices paid to small farmers. Thus, he implicitly emphasizes a certain determination of the base wage by the income in not typically capitalist organizations. However, since only a preliminary draft of this paper is available to us (it was presented at the seminar sponsored by IPEA-INPES in Gramado (State of Rio Grande do Sul), in December, 1978) we will not analyze it in detail in this paper.

(Editor's note: Bacha's paper, cited above, is being published in this issue of BES, p. 131).

[6] P. R. Souza, "Las Desigualdades de Salarios en el Mercado de Trabajo Urbano", in *Revista de la CEPAL*, no. 5 (Santiago, first semester of 1978).

Thus, they are integral parts of the overall economic structure. The process of capital accumulation requires harmony between the pattern of accumulation, the structure of production, the composition of demand, wage distribution and financing mechanisms needed to carry out current production. Thus, a variation in the wage rate not only brings about changes in wage distribution, but also involves changes in the composition of demand. These changes, in turn, require further changes, being it in the structure of production, being it in financing mechanisms for businesses or consumers, in order to be viable from the point-of-view of capital accumulation. [7]

A brief reference to the theoretical framework used in this study is necessary, although we shall not present a detailed discussion of the determinants of the wage rate in the economy, since it has been the focus of other studies. [8] The wage rate in the capitalist economy is determined endogenously, responding to two types of problems. First, it depends on the process of capital accumulation. Thus, a wage rate which does not meet the needs of the process of accumulation simply would not survive. A given wage rate is part of a given set of variables and processes which should be coherently related in order to permit capital accumulation. Second, the wage rate depends on the correlation of social forces involved in the struggle for the division of the product of the capitalist economy. This struggle can be explicit (when wages are the result of a process of direct negotiation) or be concealed, leaving it to the State to uncover its results.

It is important to remember that this process of interaction determines the wage rate in the economy at a given point in time. However, more than one result is possible. In fact, at any given moment, various wage rates are viable, if other elements of this true system of equations are appropriately adjusted to permit the reproduction of capital. Nevertheless, there are limits within which the wage rate can vary historically. The upper limit is a function of the trend of technical progress and of labor productivity; the lower limit, in the last instance, is expressed by the value of the goods necessary for the physical reproduction of the labor force, as discussed in another study. [9] Our position, therefore, is diametrically opposed to the concept of a "natural" wage rate, or the

[7] It is important to note that we are not assuming a deterministic design or relation of causality or precedence. Even without this assumption, however, it can be conceded that relations between distribution and accumulation are, at a minimum, those of interdependence and mutual determination.

[8] See, for example, P. R. Souza, "Salário e Mão-de-Obra Excedente", presented at the Sixth National Meeting on Economics of ANPEC (São Paulo, 1978).

[9] *Ibid.*

existence of external limits to the capitalist economy which set the parameters to which it should be adjusted. On the contrary, we assume that capitalism is sufficiently "strong" and dominant in Brazil to set its own parameters!

3 — Critiques of the importance of the minimum wage

While empirical evidence indicated a sharp decline in the real value of the minimum wage since the early 60's, and especially since 1964, there has been proliferation of analysis characterizing the decrease in the importance of this variable as an explanation of the wage level for unskilled labor. In support of the latter argument are to be found statements such as that of Minister Delfim Netto, "At any rate, the data of the PNAD • also show that the percentage of people who earn the minimum wage has decreased consistently during the period" (1970-1976).[10] Other statements have been made, which, without this objective, attempt to work more systematically with available information. Included in this latter group are Macedo and Garcia, who, analysing census data from the PNAD and from the Report of the "Law of the Two-Thirds", concluded that:

> "in summary, the findings presented... allow us to conclude that: a) in the overall picture of the personal distribution of (monetary) income the percentage of people who receive the minimum wage is limited, since a large percentage of those who receive monetary income from some source do not receive even the minimum wage level established by the Government; b) the explanation for this is that there are incomes derived from other sources and that they are not restricted by this legal minimum, through circumvention of the law by the existence of non-monetary income and by the existence of informal relations of employment, the very nature of which places them at the margin of legal restrictions; c) despite the limited coverage of the minimum wage, there are indications that the minimum wage is *losing importance as a standard of remuneration of the urban labor market*. These indications are clearer in the State of São Paulo than in other regions (e.g. Minas Gerais, Espírito Santo), whereas in the Northeast these signs are practically non-existent".[11]

• *Translator's Note*: PNAD — Pesquisa Nacional de Amostras por Domicílio. In English, National Survey of Household Samples.

10 A. Delfim Netto, "As Classes Baixas Têm de Agir para Ganhar", in *Jornal do Brasil* (October 22, 1978), p. 39.

11 R. Macedo and M. E. Garcia, *op. cit.*, p. 18 (our underlining).

It is not the purpose of this paper to discuss conclusions (a) and (b), which appear to be empirically well founded. However, as was stated above, our central objective is not to prove that several categories of unskilled laborers came to earn more than the minimum wage, but to determine to what extent minimum wage is important in the determination of the structure of remuneration of the industrial system, including the large firm. Nor will we consider the findings in relation to the other states mentioned. The findings present a basic methodological problem in that they measure the quantity of people with earnings up to the largest minimum wage in effect in Brazil, a wage which is not applied in these regions. Thus, we shall concentrate on the case of São Paulo and, more specifically, in the case of those employees registered with the Ministry of Labor, through statements of firms in relation to the "Law of the Two-Thirds". The authors cited above concluded that: "... a widespread decrease in the proportion of workers receiving up to 1.5 minimum wages took place over the course of the period 1968-1974, in the city of São Paulo, within the formal sector covered by the CLT...".[12]

Before examining the merit of this statement, it is important to point out a methodological problem in the comparison between the wage data at a given point in time and the minimum wage in effect, which apparently was not taken into account by said authors. It is known that Brazilian Government's policy in relation to wages in effect, especially since 1967 and at least until 1978, coherently ordered not only minimum wage readjustments but also the diverse labor categories, through coefficients which were applied monthly to collective wage agreements.

Disregarding variation both in the "productivity indices" utilized in wage readjustment formulas as well variations in the formula itself, the readjustments for each category and in the minimum wage (annualized in the period under examination) tend to reflect variations in the cost of living in the 12 months preceding the date of their readjustment. Thus, comparing the proportion of people having earnings equal to any multiple of the minimum wage, at any point in time between the date of its last readjustment and the readjustment of the labor category, the proportion of workers whose wages most approximate the minimum wage should decrease if there is a decline in the rate of inflation. The opposite would take place if the collection were made between the readjustment of the labor category and that of the minimum wage. Even if there were no changes in the wage classes of a given category, and even if its "well-being", measured in "units of well-being bestowed by

12 *Ibid.*, p. 14. Translator's note: CLT is the Consolidated Labor Legislation.

the minimum wage", were maintained over time, the proportion of people who at a given moment receive up to one or two times the minimum wage can vary by the effect of decrease in the rate of inflation and by the time transpired between the readjustments.

In the case of the figures used by Macedo and García, their conclusion is probably valid, since the data collection takes place in the month of April, just prior to the readjustment in the minimum wage. However, they do not clarify whether the wages which they use are annualized monthly averages, or whether they are wages in effect in the month of April of each year. Nor is it clear as to whether the minimum wage which serves as comparison is that in effect in April or is a weighted average of the minimum wages in the biennial periods considered (1971-1972 and 1973-1974). As may be inferred from our argument, the methodology of calculation can bias the result. Let us assume, however, that such methodological adjustements do not alter the results obtained by the authors.

It is important to emphasize three conclusions which the authors reach on the basis of their analysis:

a) "An attempt of this type (to increase in the nominal minimum wages), if not frustrated by an inflation which immediately reduces the real value of the nominal wages set, would probably lead to a *widening of the informal market* where wage levels are set without official government approval". [13]

b) "... We should discuss why the sharp decrease in the real value of the minimum wage, which took place in the principal regions of the country, was not accompanied by identical behavior of wages in general, as observed in the empirical evidence presented. It is understood that this took place due to the labor market conditions which reduced the incidence of the minimum wage set by the Government". [14]

c) "At this point, it should be clear to the reader that Macedo and García are skeptical with regard to the effectiveness of the minimum wage as a policy instrument which, seeks to aid low income classes. Even though some of the findings presented are debatable, has a whole they demonstrate that, the effect of the minimum wage has been overestimated with respect to its capacity to aggravate or alleviate the problems of poverty and income distribution". [15]

[13] *Ibid.*, p. 44 (our underlining).

[14] *Ibid.*, p. 45.

[15] *Ibid.*, p. 49.

The following hypothesis and conclusions presented by Macedo and Garcia are clear: a) labor supply and demand conditions determine the wages in the labor market, *independently* of official policy; b) an "artificial" increase of the minimum wages promotes an increase in informal employment; and c) the average income of "informal" activities determines the wage rate of "formal" or capitalist activities of the economy. Conclusions (b) and (c) assume (alternatively or complementarily) the following hypothesis: an increase in the minimum wage causes a decrease in employment in the strictly capitalist units of the economy, obliging a larger number of people compete for the portion of the market met by the informal units; and, due to an increase in the minimum wage, the firms simply circumvent the law, paying less than this level, although formally stating the contrary.

We shall not attempt to evaluate the theoretical merits of the neoclassical postulation on the functioning of the labor market which serves as a point of reference for said authors, as it is beyond the scope of this article. Nevertheless on the basis of other hypothesis, we wish to illustrate that the same data used by the authors can be interpreted so as to reaffirm the importance of the minimum wage in the determination of wage rates for unskilled labor in the economy, and of incomes in general.

In this analysis, we shall reject the assumption that the wage rate of the capitalist segment of industry is "set by the market", relatively independent of governmental policy. Taking the argument to the extreme, we shall assume that this rate is determined by the minimum wage policy which, establishes guidelines for wage levels and several types of income for unskilled labor in other forms of production organization existing in the urban economy of underdeveloped countries. Thus, the small units of industry, commerce or services, which employ workers in jobs which are precarious, fortuitous, intermittent or unstable, utilize minimum wage in effect as a standard of reference. This does not mean, however, that the relation between these wage levels and the minimum wage is always the same or even that the wage levels must always fall above or below the minimum wage. Other elements influence the wage levels and can act in even opposing directions. The level of average output per worker in these organizations, for example, is another important element to be considered and depends on the size of the market in which these organizations operate and on the volume of employment; on the other hand, the absolute level of the minimum wage is also a factor to be considered: its proximity to the level of subsistence, *stricto sensu*, or the greater incidence of some "fixed" costs of worker's budget (such as transportation) can, in practice, preclude a wage level which is lower than the legal

minimum wage. Other elements could be listed here to explain the difference between wages paid in small businesses and the wage rate in capitalist industry. Similarly, we can reason that many "self-employed workers" who sell semi or unskilled services use the minimum wage as a standard of reference for the rates charged for their services.

In other words, we assume that there actually exists a relation between incomes in the "informal sector" and the wage rate of the capitalist economy. However, contrary to what is postulated by the referenced authors, it is the wage level in the capitalist segment which influences the income level in the informal sector, and not the contrary. Furthermore, we are postulating that the wage rate in the capitalist segment is determined by the requirements of capital accumulation and by the struggle between labor and management within this segment, which can be defined by the official minimum wage policy, as mentioned below. The second hypothesis which we would like to introduce is that the capitalist units of the economy do not have the option of paying less than the minimum wage, unlike the small economic units (which do not always use wage labor) or in some cases of very small firms, which can possibly avoid the labor legislation.

On the basis of these two hypothesis, it can be argued that, although the minimum wage continues to establish the bias for the wage levels in the capitalist segment of the economy and constitutes the parameter for guidelines for income levels of the remainder of unskilled urban labor, the income distribution figures can, in fact, record decreasing proportions of the labor force earning below or slightly above the legal minimum wage. Thus, in medium and large businesses in Brazil, the lowering of the wage floor during the 1960's occurred simultaneously with a widening of the range of wage levels.

In small and medium enterprises, wages continue to be influenced primarily by the minimum wage. However, while in the second half of the 1950's such enterprises paid less than the minimum wage, since the mid-sixties they came to equal the legal minimum wage, due to a series of factors which will be discussed later in the text. The same occurred with regard to the earnings or self-employed workers and those of workers in small-scale services.

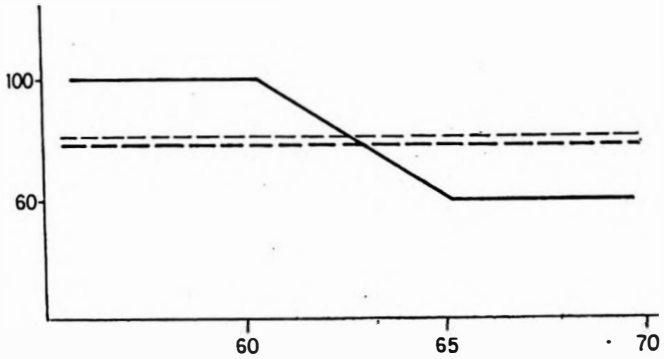
Within this framework, it is perfectly possible that, while fulfilling its functions in the Brazilian economy, the minimum wage may have lost importance in the labor income distribution structure. Graph 1 illustrates the difference between the position held by Macedo and García and our own.

Alternative A illustrates the position of those who maintain that the market determines the wage level through the supply and

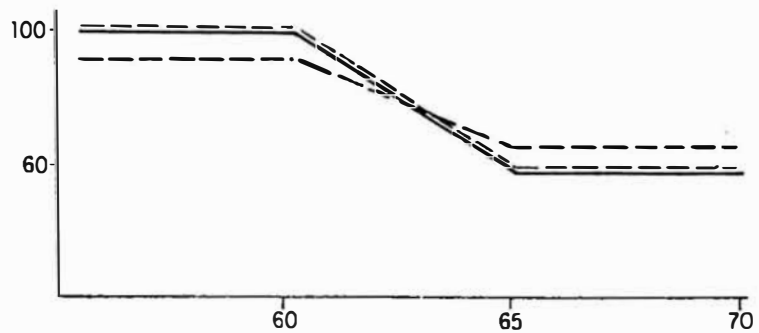
Graph 1

ALTERNATIVE INTERPRETATIONS OF THE RELATION BETWEEN INCOME OF UNSKILLED WORKERS EMPLOYED IN SMALL-SCALE COMMERCIAL PRODUCTION, OFFICIAL MINIMUM WAGE AND THE WAGE RATE IN BRAZIL: 1955-1970

ALTERNATIVE A:
Wage rate determined by income in small-scale commercial production; the official minimum wage had little influence in the functioning of the labor market.



ALTERNATIVE B:
The wage rate was determined by the minimum wage and established guidelines for the determination of income in small-scale production.



--- wage rate
——— official minimum wage
--- income in small-scale commercial production

demand of laborers and that the income of small businesses, in the final analysis, is what determines the level at which the base wage can be set. It should be observed that the fact that we are drawing these curves horizontally does not mean that we are interpreting that the authors who subscribe to a similar position are postulating by the constancy of the real income of the informal sector or of the wage rate during this particular historical period. In fact, both curves can be drawn with a positive, negative or variable slope. Our objective is to comment on its independence in relation to the minimum wage and the direction of the determination which flows from commercial income to the base wage of the capitalist segment, rather than the contrary, as we believe.

Our position is illustrated in Alternative B. It is important to emphasize that the wage rate was circumstantially determined by the minimum wage. The wage rate is endogeneously determined within the capitalist segment of the economy by wage negotiations (among other things) rather than by the laws of supply and demand and influences the determination of commercial income. Nevertheless during this particular historical period and, until present time the character of capitalist development in Brazil has made it possible for the State to assume the function of defining (not to be confused with *arbitrating*) the dispute between the classes through its minimum wage policy. It is therefore unnecessary to verify whether minimum wage demands originated in workers' struggles for higher wages or if, on the contrary, they strictly responded to the populist political model which lasted until 1964. Our central objective is rather to analyze the role actually played by the State.

As can be observed, there are two hypothesis to be empirically tested. As will be discussed later on, there are facts which indicate that our interpretation is correct with regard to the relation between the minimum wage and the wage rate during this historical period. With the available data, it is impossible to test the validity of the second part of the argument, i.e. that the direction of a causal relationship between the commercial income of unskilled labor and the base wage is from the latter to the former. However the opposing position does not present empirical proof either, and bases its argument on an assumed "transparency" of the unskilled labor market and a supposed significance of the price-elasticity of demand of labor. In addition, the theoretical hypothesis of this position assume the choice of *individuals* to move from one to another productive sphere, according to the fluctuations of wage levels obtained by labor. In this respect, our hypothesis is based much more on the dominante character of capital, which determines not only its labor force needs, but also commands the move-

ments of labor employed in those forms of organization which are not specifically capitalist, destroying them and recreating them in its movement of expansion.

4 — A pseudo-solution: the wage median as the estimator of industrial wages

In recent years, Bacha has been attempting to measure the wage rate trend in Brazilian industry. Aside from an earlier article,[16] in other more recent papers, he maintains the position of adopting the median of the wage distribution as the basis of the industrial wage trend.[17]

Bacha states that:

> "insofar as there was a decline (in the minimum wage) this (the findings of Macedo and others) demonstrates that the Government cannot exert complete control over market wages through minimum wage guidelines. But we should not abandon the position in which the market wage elasticity for unskilled labor with respect to the official minimum wage is equal to one (the position apparently assumed by the critical literature) to adopt the opposite extreme, in which this elasticity would be equal to zero. In fact, according to the regressions... (from 1952 to 1975 for minimum and median wages of industry in Rio de Janeiro), the median wage elasticity with respect to the minimum wage is approximately 0.5, a very reasonable coefficient considering that, at least since 1965, workers earning up to the minimum wage comprised less than 40% of the labor force in the manufacturing industry of Rio".[18]

In a situation in which the wage structure has a fan-like spread, which accentuates the differentiations (as indicated in various studies such as Bacha's) the adoption of a variable such as the median wage logically allows for a less inappropriate measurement

[16] Milton da Mata and Edmar L. Bacha, "Emprego e Salários na Indústria de Transformação, 1949/69", in *Pesquisa e Planejamento Econômico*, vol. 3, n.º 2 (June, 1973), pp. 303-340.

[17] Edmar L. Bacha, *op. cit.*, and Edmar L. Bacha and L. Taylor, "Brazilian Income Distribution in the 1960's: 'Facts', Model Results and the Controversy", in *Journal of Development Studies*, vol. 14, n.º 3 (April, 1978), pp. 271-297.

[18] Edmar L. Bacha and L. Taylor, *op. cit.*, pp. 287-288.

of industry's wage rate trend than other indicators, such as the average wage.

In the wage trend, the independent variables are the wage rate and the spread of the wage structure. The latter can vary from the lowest wage levels as well as be restricted to the medium and upper wage classes. Thus, both the average and the median can vary, differently from the wage rate. Nevertheless, it is important that, contrary to the wage rate (which is an independent variable) the measure is necessarily a variable which reflects *ex-post* the action of the independent variables cited above.

Thus, we believe that the concern with this variable as an indicator of the well-being of wage-earners in Brazil, as Bacha considers it to a certain extent, is correct and legitimate. However, it is apparently incorrect, based on a regression analysis between median and minimum wages, to diminish the importance of the minimum wage in the determination of the industrial wage rate, as Bacha also wishes to do. It is precisely because all the wages have a fan-like spread, especially since the second half of the 1960's, that such a conclusion cannot be inferred. It is true that the widening of the wage spread occurred principally in average and high wages, but there is no proof that the phenomenon did not take place among the lower wage levels. Only in the case in which the wage distribution among the 50% lowest paid laborers remained unchanged can the importance of the arguments of the "critical literature", as Bacha refers to it, be diminished, based on his findings. Only in this situation would the median wage reflect the wage rate trend, since this trend should, by definition, behave exactly like that of the median.

It can be argued that there is a semantic problem in the current debate, because Bacha and Taylor would be working with different concepts of our wage rate. In fact, such a criticism is valid, but in our view this validity is only apparent. The referenced authours do not attempt to measure the wage floor through the median wage; yet, in relating their median to the minimum wage, they implicity analyze the relevance of the minimum wage in the determination of the industrial wage rate.

Thus, contrary to what understood in a preliminary reading, Bacha's results give great emphasis to the association between wage rate and minimum wages. If this is not the case, how could one explain why, in a wage structure which is opening, half of the variations from the median may be explained by the minimum wage fluctuations?

5 — The wage rate in São Paulo industry

5.1 — General considerations

The analysis presented thus far could lead the reader to assume that we are postulating that a significant portion of labor in the large Brazilian industrial firm is being paid at the minimum wage level. Obviously, this is not the case. What is meant to be said is that, even in the case of the large industrial firm with virtually no workers receiving minimum wage, the minimum wage is fundamental for the determination of the wages of a significant portion of its labor force.

First, let us consider the trend of the official minimum wage in real terms, as illustrated in Graph 2. In very general terms, we can identify two levels of minimum wage in the post-1952 period: one level characteristic of the second half of the 1950's and the other more clearly defined since the mid-1960's. The level of the latter period is, on the average, 40% lower than that of the first period. In other words, not considering variations in relative prices, the minimum wage rate in the Brazilian economy which would allow for the maintenance of its real value of the second half of the 1950's should be almost double its current nominal value.

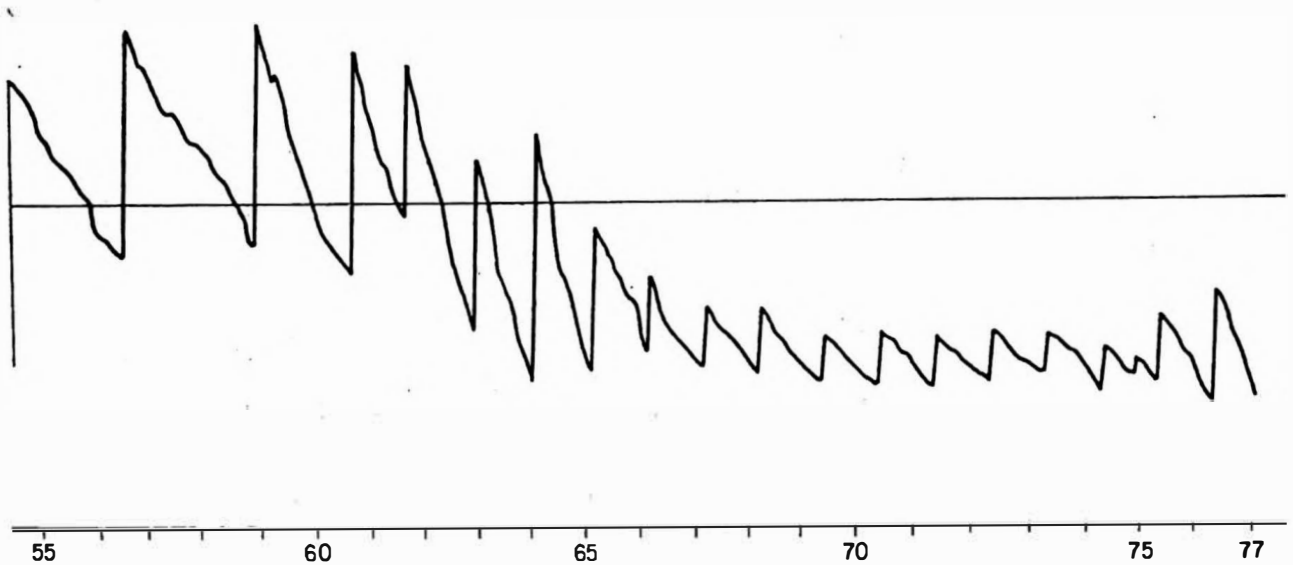
Now let us look at the wage structure in Brazilian heavy industry in a modern sector: the automobile industry (see Table 1). Observe that the percentage of individuals included in the income classes which earn close to the minimum wage is very significant. Thus, 25% of the workers of the largest Brazilian firms in this sector have wages lower than two or two-and-one-half times the minimum wage in effect in the period (depending on the month used as reference). Also note the high percentage of people who receive less than the average wage. If the minimum wage today were double what it is, the earnings of the labor force or heavy industry would be substantially different than it currently is. The wage differences within the firm would probably not be so large, since lower paid workers would have a wage level equivalent to double the current level, and the wage of the unskilled worker would be slightly differentiated in relation to the minimum wage.

We could add other elements which corroborate the previous position. It would be difficult to presume that large industry illegally under-paid its labor during the period (for evample, since the second half the 1950's). The assumption that the legal minimum wage was the wage *floor* determining the wage rate of large industry in the period under examination as well is supported by the fact

Grahp 2

REAL MINIMUM WAGE: JANUARY 1952 TO APRIL 1977

BASE INDICES: JANUARY, 1952 = 100



Nominal minimum wage including the 13th monthly wage and the 10% bonus beginning in December 1974, deflated by the cost of living index calculated by the Fundação Getulio Vargas.

Table 1

Contractual Wages in the Automobile Industry: Wages in Effect in April and May, 1978[a]

(Cr$ and %)

Companies	Average Wage	Percentage Below Average Wage	Median Wages	25% of Workers Earn Less Than:
Scania	6.458,00	73,4	4.805,00	2.540,00
Volkswagen	6.363,00	69,6	5.055,00	2.707,00
Mercedez-Benz	5.715,00	73,3	4.767,00	2.774,00
Ford	5.718,00	73,0	4.902,00	2.770,00
Minimum Wage in Effect at the Time:		Cr$ 1.086,00 in April, 1978.		
		Cr$ 1.560,00 in May, 1978.		

SOURCE: DIEESE, *Guias de Recolhimento da Contribuição Sindical* (unpublished data).

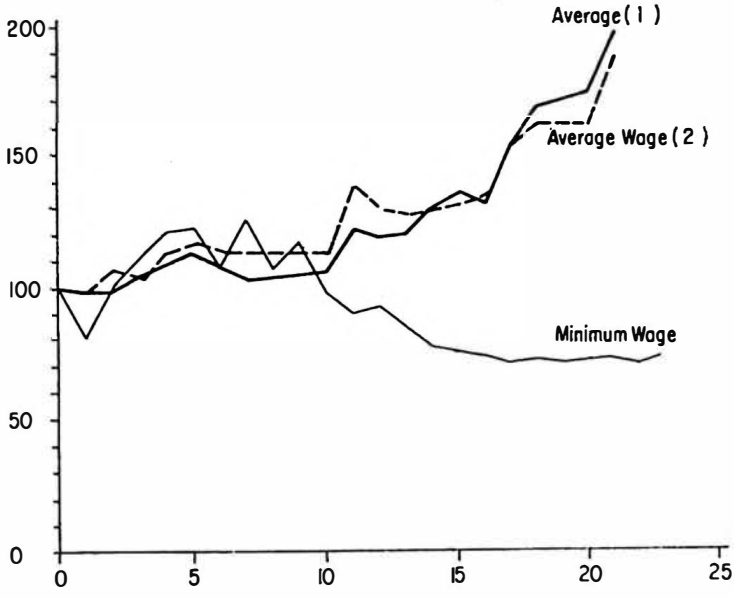
[a] Corresponds to readjusted wages as of April, as determined by the collective wage agreement of 1978 and prior to the readjustments of 11%, attained as a result of a strike, as of June of that year.

that there was more government monitoring of large firms taying place and by the increased influence of labor unions in that period, as compared to the post-1968 period. In this context, the reduction of the minimum wage through the wage policy, especially after 1964, takes on a new dimension, since it shows how the large firm basead its wage rate on the sharp decrease in the minimum wage. If this were not the case, or rather, if the wage rate of large industry had been maintained in real terms at its level of the late 1950's, the data of Table 1 and those which are analyzed below would show a much lower proportion of workers within the class earning between one and two minimum wages (40% lower today than during the period referenced).

For the purpose of illustrating several of the elements elaborated here, we shall compare the trend in average wages of the industrial sectors and the trend in the minimum wage. To this end, we include graphs 3 and 4, corresponding to the period 1952 to 1976 of the wage trend in the Machinery Industry and in the Clothing, Footwear and Cloth Goods Industries. The curves corresponding to the Machinery Industry indicate trends and slopes very similar to those of the Transportation Equipment, Electrical and Communications Equipment, Metals, Chemicals and Pharmaceuticals, Paper and Cardboard, Beverages and Tobacco Industries. The latter group can be representative of the Textiles, Wood, Furniture, Rubber, Leather and Hides and Miscellaneous Industries, while the Food Products and Non-Metallic Minerals Industries

Graph 3

THE BRAZILIAN MACHINERY INDUSTRY: THE TREND IN THE REAL AVERAGE WAGES OF WORKERS AND THE MINIMUM WAGE



SOURCES: FIBGE, *Pesquisas Industriais* and *Censos Industriais*.
(1) Deflator: Industrial Price Index
(2) Deflator: Cost of Living Index

have find themselves in intermediary situations between the two patterns. [19]

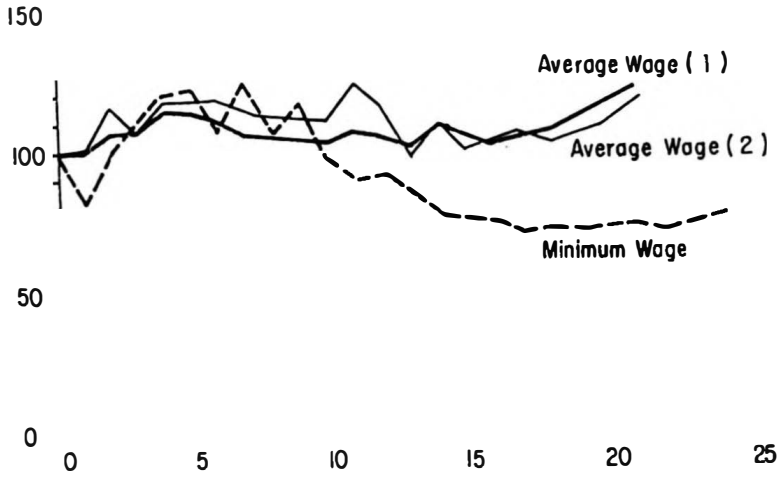
In both cases, it can be noted that the index of average wages precisely follows the minimum wage trend until 1961. [20] Given that it is unlikely that the large industries paid less than the minimum wage, this fact can be explained completely by two factors; a) little

[19] Logically, academic rigor would advise a more sophisticated statistical treatment to relate the industries among themselves. In the present instance, however, such a procedure is unnecessary because we simply intend to elucidate assertions that will be better proven by the use of more appropriate data than average wages for industrial sectors throughout the country. The data for the industrial sectors are presented in Table 6.

[20] Until 1962, the data refer to average wages of workers. Since 1963, these data represent average wages of "production personnel". This partially explains the increase in average wages since that year.

Graph 4

THE BRAZILIAN CLOTHING, FOOTWEAR AND CLOTH GOODS INDUSTRIES: TRENDS OF THE REAL AVERAGE WAGE AND THE MINIMUM WAGE



SOURCES: FIBGE, *Pesquisas Industriais* and *Censos Industriais*.
(1) Deflator: Industrial Price Index
(2) Deflator: Cost of Living Index

differentiation in the wage structure of all the industries which, as a matter of fact, has already been suggested for this period in other papers; [21] and b) circumvention of the law by small firms, by paying less than the minimum wage. Since 1962, there has been clear difference in the trend of the curves of the two sectors. In the Machinery Industry, the average wage moves further and further away from the minimum wage. The inverse of the two factors mentioned is probably the explanation for this phenomenon. In the first case, the greater diversification and sophistication of the Machinery Industry since the 1960's is obvious. In the second, the same reduction of the minimum wage to the levels of strict subsis-

[21] Milton da Mata and Edmar L. Bacha, *op. cit.*, and P. E. Baltar, "Diferenças de Salário e Produtividade na Estrutura Industrial Brasileira" (Campinas: UNICAMP, 1977), mimeo.

tence, together with the increased strenght of labor unions until 1964 and greater technical regulation of the Ministry of Labor, certainly allowed and/or induced the small firms to obey the law. In the case of the Clothing Industry, less dynamism, less technical sophistication of the industry, less concentration, etc., surely explains why its wage structure is less diversified than the Machine Industries. This explains the more limited growth of its average wages, even in a context in which the small firms probably began to pay the minimum wage.[22]

Thus, although the minimum wage served as the basis for industrial wages, determining the wage rate even for large industry, the growing dichotomy between the minimum and the average wage can be understood. This explanation is also totally compatible with the position that it is the wage rate of industry (determined by the minimum wage) which serves as a guideline for the wages of all firms, large and small. The large firms must always pay above the minimum wage and the small firms may or may not, depending upon the strenght of the labor union, and how closely the firms are monitored by the government. Nevertheless, the wages paid by small firms are influenced by the minimum wage, although they are inferior to it.

5.2 — The wage rate for the metal workers of São Paulo

Statistics from a study conducted by the DIEESE show wage distribution in the professional category of metal workers of the city of São Paulo for selected years in the period 1956-1976.[23] This source allowed us to analyze the wage distribution of unskilled production labor. For our purpose, this is fundamental insofar as we consider the wage rate as the base-pay of unskilled labor.

First we should state that, for the purpose of the study conducted by DIEESE, unskilled labor is the category which encompasses occupations composed of simple tasks which can be learned in a short period of time, not requiring the ability of judgement nor any type of technical knowledge, but in general, physical strength. On the other hand, the wages considered here correspond

[22] It is interesting to observe further that in the case of the clothing industry, the rising trend in real average wages is clear only since 1967. This year marks the moment in which the policy of lowering the wage floor through the minimum wage was fully "accomplished", as can be observed in Graph 2.

[23] DIEESE, "Distribuição Salarial em São Paulo segundo as Guias de Contribuição Sindical" (São Paulo, 1977), mimeo. A random sample of 10% of the Union Contribution Withdrawal Registers was taken and from these a random sample of 10% of employees in the selected firms was chosen at random.

to the contractual wage declared in the union contribution withdrawal register and refer to the month of March of each year.[24]

All the indicators of central trend of the wages of the unskilled São Paulo metal workers indicate the sharp decrease of its real value from 1961 to 1971, with subsequent recovery in 1976 in relation to 1966 (see Table 2). Note, furthermore, the similarity of the behavior of the mode in relation to the first quartile and of the average and median in relation to the third quartile. In the first set of indicators, the decrease occurs in the same proportion in the periods 1961-1966 and 1966-1971, in 1976 recovering the value which it assumed in 1966. In the case of the average, median and third quartile, the decrease is much sharper in the period 1961-1966 than in the period 1966-1971, and 1976 surpasses the value recorded in 1966, although it is still much lower than in 1961. Consequently, we can conclude that between 1961 and 1966 there was a sharp decline in the earnings of unskilled metal workers and, at the same time, a decrease in the degree of its dispersion. In the period 1966-1971, on the other hand, the decline in the wages of unskilled metal workers affects to a much greater extent those having lower earnings, which involves a sharp increase in its dispersion.

Table 2

Wage Trend of Unskilled Metal Workers of São Paulo

	1956	1961	1966	1971	1976
1st Quartile*	100,2	100,0	77,1	58,7	76,0
Median	98,3	100,0	73,6	62,9	80,8
3rd Quartile*	99,9	100,0	72,9	68,2	80,5
Average	94,8	100,0	74,8	65,6	80,8
Mode	100,0	100,0	77,1	57,2	76,0

OURCE: DIEESE.

Refers to the wage which sets the upper limit of the respective quartiles.

24 Therefore, we are dealing with the contractual wage as it appears on the workers' labor registration card. The question can be raised that this is only part of the workers' earnings. Nevertheless, we are comparing it with the minimum wage, which has the same characteristics.

The previous observation can be confirmed comparing the interquartile and interdecile deviations (see Table 3). Actually, the wage dispersion of unskilled metal workers decreased between 1961 and 1966, then increasing significantly between 1966 and 1971. In 1976, the dispersion was again diminished, although it maintained a higher level than in 1961.

Table 3

Wage Dispersion Measures of Unskilled Metal Workers in São Paulo [a]

	1956	1961	1966	1971	1976
$\frac{3^{rd} \text{ Quartile} - 1^{st} \text{ Quartile}}{1^{st} \text{ Quartile}}$	0,287	0,290	0,218	0,500	0,367
$\frac{7^{th} \text{ Decile} - 3^{rd} \text{ Decile}}{3^{rd} \text{ Decile}}$	0,215	0,258	0,200	0,321	0,333
$\frac{8^{th} \text{ Decile} - 2^{nd} \text{ Decile}}{2^{nd} \text{ Decile}}$	0,375	0,355	0,286	0,655	0,531
$\frac{9^{th} \text{ Decile} - 1^{st} \text{ Decile}}{1^{st} \text{ Decile}}$	0,796	0,516	0,414	1,000	0,901

SOURCE: DIEESE.

[a] The measure of dispersion takes those wages which set the upper limits of the quatiles or deciles specified and relates them as indicated in the table.

The official minimum wage apparently behaved more favorably than the wages of unskilled metal workers of São Paulo in the period 1956-1961 (see Table 4). This observation should be clarified. In March of 1956, it had been 17 months since the last readjustment of the minimum wage, and there had been an increase in the cost of living in São Paulo in this period of approximately 34.8%. On the other hand, in March of 1961 it had been only five months since the last readjustment in the minimum wage, and there had been an increase in the cost of living of 17.4%. This explains why the wages of the metal workers in March of 1956 were higher than the minimum wage, whereas in March of 1961 they were very close to the minimum wage.

Table 4

Minimum Wage and Wages of Unskilled Metal Workers in São Paulo

	1956	1961	1966	1971	1976
Minimum Wage in March[a] (Index: 1961 = 100)	82,5	100,0	76,0	56,4	55,4
1st Decile in Relation to the Minimum[b]	1,00	0,99	1,00	1,00	1,18
2nd Decile in Relation to the Minimum[b]	1,13	0,99	1,00	1,00	1,31
3rd Decile in Relation to the Minimum[b]	1,20	0,99	1,00	1,07	1,35
4th Decile in Relation to the Minimum[b]	1,20	1,05	1,00	1,12	1,50
5th Decile in Relation to the Minimum[b]	1,29	1,08	1,05	1,21	1,58

SOURCE: DIEESE.

[a] Index of real wages; base: 1961 = 100.

[b] Relation between the wage which sets the upper limits of the deciles and the minimum wage in effect.

Since 1961 and until at least 1971, the behavior of the wages of unskilled metal workers of São Paulo has been similar to that of the official minimum wage, with the qualification that during the sharp decrease of wages of those metal workers between 1966 and 1971, there was an increase in their dispersion, or rather, only the lower wage levels of unskilled metal workers closely followed the behavior of the minimum wage between 1966 and 1971. Remembering that between 1961 and 1966 the Brazilian economy faced a serious crisis, whereas between 1966 and 1971 it recovered and began to expand, we can state that the real decrease of the minimum wage in crisis conditions lowered the wage of all unskilled metal workers of São Paulo. In the recovery and subsequent expansion, on the other hand, the minimum wage only depressed the pay of those unskilled workers who had lower wages.

Between 1971 and 1976 there seems to have been a "displacement" of the wage of unskilled metal workers of São Paulo from the legal minimum wage. The wage of the unskilled metal workers behaved more favorably than the minimum wage, which maintained its real value between March 1971 and March 1976 (see Table 4). It is interesting to note that this took place during a peak in economic activity and the beginning of recession with accelerated inflation. At least part of that "displacement" can be explained by the acceleration of inflation; in other words, the fact

that the yearly readjustment of the minimum wage for those two for those two years takes place in May, and that the yearly readjustment for metal workers takes place in November implies a period of accelerated inflation at the end of the period. It also implies that the wages of the metal workers increased at a faster rate than the minimum wage, or rather, that there was an increase in the cost of living of 18.4% between May 1969 and May 1970, whereas it increased by 17.2% between November 1969 and November 1970. Then between 1974 and 1975, the respective rates were 26.7 and 30.9% in the months of May and November. Therefore, the difference between the annual increase in the cost of living in the periods of readjustment of the minimum wage and of the wage of the metal workers increased in favor of the latter. This partially explains why in March of 1976 the wages of unskilled metal workers had a more favorable relation to the minimum wage than in 1971. Thus, disregarding factors such as changes in the readjustment formula and in the criteria of determination of the minimum wage between the two years, the simple acceleration in the price increases indicates that the wages of the metal workers in March of 1976 should supersede, on an average more than 3%, its 1971 relation to the minimum wage. Nevertheless, we see that, for example, the distance between the first decile and the minimum wage grew by approximately 18% in relation to the 1971 situation. Therefore, the metal workers' wage floor rose in relation to the minimum between these two years.

We believe, however, that this fact does not invalidate our conclusions. As we observed previously, more important than the 15% increase was the sharp decrease of approximately 40% which took place during the 1960's, a period during which the metal workers' wage rate accompanied the variation of the minimum wage.

This growing gap corresponding to the five year period 1971-1976 requires further explanation. First, the wage readjustment formula was modified in early 1975, which may have meant an increase in the readjustment rates for metal workers not considered in the readjustments of the minimum wage. Second, between the two years compared, the São Paulo economy experienced an expansion of industrial employment unprecedented in Brazilian history. The growth rate of industrial employment in the State of São Paulo, between 1970 and 1974, was approximately 9.3% per year.[25] Obviously, such a market situation with minimum wage

[25] This figure is produced by the comparison of monthly averages of individuals employed in the two years, according to the Industrial Census and the Industrial Research Study, respectively. In both cases the data refer to establishments employing five or more people or having a production value equivalent to 640 times the minimum wage in effect in that year.

conditions may have produced a small increase in the wage rate in relation to the minimum wage. This, however, does not negate the determinant importance of the minimum wage, as is clearly demonstrated by the previously indicated magnitudes.

5.3 — Wages in the civil construction industry of São Paulo in the recent period

In an attempt to more precisely characterize the behavior of the wage rate in São Paulo in the recent period, information on the trend of hourly wages in the civil construction industry were surveyed.[26] It is not our intention to thereby maintain the hypothesis that the behavior of the wage rate in he civil construction industry should correspond to that of other labor categories, particularly that of the manufacturing industry. In fact, it can be expected that the compartmentalization between the construction labor and that of the manufacturing industry is generally greater, than that which is observed among diverse occupational categories within the industry. On the other hand, the expansion of the civil construction industry can be disconnected from the general economic expansion, since its behavior was largely influenced by the incidence of major public works projects.

The figures in Table 5, therefore, should be regarded with caution, especially in their comparisons with the wage data of the metal workers. The relevance of the minimum wage in the wage trend in the civil construction industry for the period 1971-1973 is clear. Between 1973 and 1974, due to a sharp drop in the average monthly level of the minimum wage, there was an increase of approximately 20% in the wages of the less skilled labor in the civil construction industry, following smaller and similar increases to those recorded in the minimum wage in the two following years.[27]

As can be inferred from the table, the minimum wage trend was relevant for the determination of the wage rate in the civil construction industry until 1973, assuming that its trend had been similar to that of the minimum wage in the decades of the 50's and 60's (which seems to be a reasonable assumption in view of the general behavior of other labor categories, as previously demon-

[26] It should be noted that we are dealing with contractual wages in both cases. The real earnings of a construction worker depends on the number of hours worked, which is the same case for any worker who receives minimum wage.

[27] The annual data were calculated using current monthly prices deflated by the consumer price index calculated by the Fundação Getulio Vargas. The wages of the civil construction industry are related to the hourly rate and minimum wages are related to monthly prices. Minimum wages include the special 10% bonus granted between November 1974 and the readjustment of May 1975.

Table 5

Trend of Minimum Wage Indices and Wages in the Civil Construction Industry in the State of São Paulo: 1971-1976
(Indices: 1971 = 100)

Years	Minimum Wage Indices	Wage Indices for Hod-Carriers	Wage Indices for Bricklayers
1971	100	100	100
1972	101	100	99
1973	103	106	106
1974	100	127	123
1975	104	136	126
1976	107	140	130

SOURCES: FIBGE, *Anuário Estatístico do Brasil*, various years, and Fundação Getulio Vargas. For methodology, see note from text.

strated). Since 1973 and at least until 1976, the influence of other factors is clear (as was noted in the case of the metal workers). The nature of these factors is uncertain to us, precisely because direct wage negotiations were resumed in Brazil only in 1978, and because the years following 1973 were characterized by the decelerating rhythm of economic growth.

6 — Final remarks

Despite the existing problems with the more recent figures, we believe to have clarified the relevance of the minimum wage in the determination of the wage rate in Brazil during the last three decades. Thus, the fact that the wage rate of a category such as the metal workers of São Paulo precisely followed the significant decline in the real values of the minimum wage between the second half of the 1950's and the second half of the 1960's, is quite revealing. It is possible (and even desirable) that this situation be modified in the Brazilian economy in the near future. Direct negotiations which have been taking place a gradually increasing pace since 1978, although still restricted to several labor categories, can be a path to be followed by the majority, insofar as the current movements are successful and the working class achieves greater organization. In this case, the wage rate would indeed be determined by these negotiations, and the minimum wage would gradually loose importance, possibly relegated to putting the labor markets of the more backward regions of Brazil into order.

Table 6

Indices of Real Average Industrial Wages — 1952/1973 [a]

Base: 1952 = 100)

Years	Official Minimum Wage	Machinery	Clothing, Footwear and Cloth Goods	Leather and Hides	Wood	Electrical and Communications Equipment	Transportation Equipment	Rubber	Non-Metallic Minerals	Tobacco	Printing and Publishing	Miscellaneous	Metals	Chemicals and Pharmaceuticals	Paper and Cardboard	Beverages	Textile	Furniture	Food Products
1952	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1953	82	99	101	96	98	99	95	88	102	109	104	104	99	99	102	91	100	98	104
1954	100	107	117	109	101	105	92	87	113	109	104	113	108	110	112	99	114	102	115
1955	112	104	107	113	100	107	88	103	112	113	100	110	112	119	106	13	107	105	119
1956	121	113	118	125	108	114	88	96	116	188	106	119	119	132	123	117	124	107	133
1957	123	117	119	130	112	120	108	104	126	150	109	123	120	144	129	121	141	112	142
1958	107	114	119	126	107	116	102	94	122	147	118	123	121	149	129	128	126	112	139
1959	126	113	116	129	121	111	101	88	119	144	104	117	119	161	127	133	123	107	143
1960	107	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)
1961	118	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)
1962	98	113	111	139	110	102	119	81	122	136	112	111	119	155	139	133	129	101	138
1963	91	139	124	144	117	133	154	113	141	154	132	129	140	211	163	151	135	119	157
1964	93	130	116	140	113	131	136	102	137	185	125	123	144	209	157	142	134	117	150
1965	87	128	109	130	112	121	125	94	133	179	117	113	130	199	139	123	124	107	142
1966	78	130	110	128	110	134	134	96	125	153	118	130	132	180	132	133	123	101	132
1967	76	131	101	118	108	126	133	102	118	145	114	115	140	187	137	131	125	94	132
1968	75	135	107	123	102	132	135	101	129	170	131	124	148	189	143	139	131	100	135
1969	72	154	107	129	110	142	169	109	136	180	143	132	144	204	151	157	136	106	135
1970	73	163	103	123	108	152	142	103	128	205	147	116	137	240	152	146	138	100	137
1971	72	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)	(...)
1972	73	163	110	143	118	146	175	132	149	222	167	114	154	226	179	194	152	112	150
1973	74	189	118	115	124	144	171	119	159	197	167	154	156	221	170	172	159	116	158

SOURCE: FIBGE, *Anuário Estatístico do Brasil*, various years.

[a] Refers to the quotient of total wages paid to workers and the number of workers as of December 31st of each year, from 1952 to 1962. From 1963 to 1973, it refers to the quotient of total wages paid to production personnel and the number of people connected to production on December 31st. Nominal wages were deflated with the consumer price index of the Fundação Getulio Vargas.

We shall not enumerate all of the consequences of the fact that the minimum wage has been a determinant of the wage rate in the Brazilian economy, since most of them can easily be inferred. Nevertheless, we do wish to call attention to one of these consequences because, in our view, it reveals one of the many fallacies consistently found in the relevant economic literature, of both Brazil and the rest of Latin America. The neoclassically inspired works generally argue that the minimum wage policy tends to "artificially" elevate the cost of labor in relation to that which would be in conditions of market equilibrium. To synthesize, let us examine a citation from the same paper of Macedo and García: "Generally spearking, the historical picture of the application of the minimum wage in Brazil falls within these considerations. Thus. the minimum wage was established above the wage which would equate the supply to the demand for labor in the labor market as a whole". [28]

Our conclusion, suggests the contrary: principally in an inflationary economy, the setting and the readjustments of the minimum wage have as their main objective "to organize" the labor market, being able to both increase and to reduce the wage rate of the economy, as the Brazilian experience of recent decades appears to demonstrate in a conclusive manner. In this respect, we are in agreement with Oliveira, [29] among others, in showing how the function of the minimum wage was precisely that of imposing a single wage rate on the economy, precluding certain categories from obtaining wage levels substantially above the rest.

28 R. Macedo and M. E. García, *op. cit.*, p. 44.

29 Francisco de Oliveira, *Economia Brasileira: Críticas à Razão Dualista* (2nd edition, São Paulo: Seleções CEBRAP, 1976).

Economic growth, urban and rural wages: the case of Brazil *

Edmar L. Bacha **

1 — Introduction

The level of wages of unskilled labor is the most important indicator of the standard of living of the Brazilian population, although literature on income distribution in Brazil offers no analysis of the long-run behaviour of rural and urban wages. This paper is an attempt to fill this gap in empirical knowledge.

The Lewis[1] growth model predicts that during the labor surplus stage the wages of unskilled urban labor will remain constant, in terms of agricultural output. This prediction is based on two assumptions: first, the earnings of agricultural laborers are not altered, which implies the productivity of labor in traditional agricultural activities is stagnant. Second, it is assumed that there exists free entry to the urban labor market, with rural-urban migration reacting to the relative wages with sufficient agility to guarantee the maintenance of a constant equilibrium differential between the urban and rural wages of unskilled labor.

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1 W. Arthur Lewis, "Economic Development with Unlimited Supplies of Labor" (The Manchester School, May, 1954). Reproduced in A. Agarwala and S. Singh (orgs.), *The Economics of Underdevelopment* (London: Oxford University Press, 1958).

At first sight, it would seem that the post-World War II industrialization process in Brazil confirms the prediction of the dual growth model regarding the constancy of the behaviour of wages. Nevertheless, a closer examination of available data indicates that the Lewisian concept of surplus labor is highly restrictive and unable to explain the complexities of the urban and rural wage trends in the South of Brazil. This paper suggests that the behavior of wages can only be understood in a type of analysis which incorporates agrarian structure, the trend in the terms of trade between agriculture and industry, government labor policy and the strength of labor unions.

We will first analyze the rural wage trend in São Paulo and subsequently the behaviour of average industrial wages in Rio de Janeiro. The paper concludes with an examination of the interactions between the political-institutional structure, the terms of trade between agriculture and industry, and the differential between urban and rural wages.

Appendix 1 details the elaboration and the limitations of the statistical series presented in the text. Appendix 2 presents new estimates of the trends in food costs in Rio de Janeiro and São Paulo between 1966 and 1977 and discusses the urban and rural wage trends of unskilled labor in the country as a whole throughout the recent phase of economic expansion.

2 — Rural wages

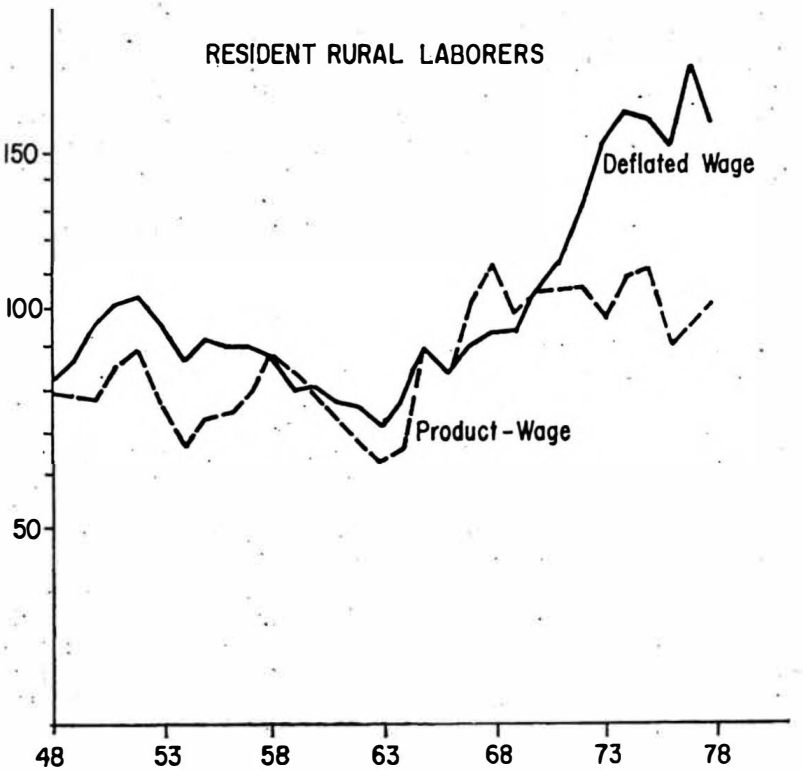
Graph 1 shows the behavior of wages of resident day laborers in São Paulo agriculture from 1948 to 1978. Two wage concepts were used: the product-wage, which is the monetary wage divided by the index of prices paid to growers in São Paulo; and the *deflated wage,* which is the quotient between the monetary wage and an overall price index.[2] The product-wage is a cost concept and is related to capitalist agriculture's demand for labor. When compared with the physical productivity of labor in the rural sector, it shows labor's share of agricultural production. The deflated wage is a purchasing power concept. It indicates the pruchasing power of rural wages in relation to the basket comprised of goods which constitute part of the GDP.

Until 1963, the rural wage was a free market rate, which tended to reflect the alternative value of labor time spent in family farm-

[2] The aggregate price index is equal to the implicit deflator of the GDP for 1965-1977. For the other years, since the relevant series was not available, we used the general price index of the FGV (Column 2 of *Conjuntura Econômica*) as an approximation of the implicit deflator.

Graph 1

DAILY WAGE INDICES OF RESIDENT RURAL LABORERS IN SÃO PAULO (1970 = 100)



ing, at least in São Paulo. In 1963, the Federal Government introduced the Rural worker's Statute and implemented the law on the rural minimum wage. This may have created a gap between the minimum wage paid in the capitalist rural sector and the value of labor time spent in family farming, but definitive judgements cannot be passed.

Le us consider the product-wage series: setting aside shortrun fluctuations, the 30-year period can be divided into two sub-periods: 1948-1966 and 1967-1978. Within each of these periods, the rural wage is reasonably constant in terms of the price of agricultural production, but in the latter period it is almost 30% higher than

the former.[3] The graph suggests that the increase in the product-wage between 1963-1964 and 1967-1968 was more a result of the change in labor legislation than of the interaction of market forces in the rural sector.

There may be some doubt as to whether the Statute in fact contributed to the increase in rural wages. The new legislation imposed the payment of minimum wages, nevertheless it permited the deduction of costs incurred with housing, electricity, firewood and food provided to the laborer's. The growers may therefore have declared payment of wages which included the value of items supplied to the laborers. Furthermore, as the author of the wage series used in Graph 1 observed, "since the minimum wage is a legal obligation, the entrepreneur, when interviewed is studies of this type, forcefully affirms that he pays wages in accordance with the law".[4]

In this respect, however, certain reservations should be held: first, the series of wages of non-resident day laborers observed in Graph 2 indicates wage earnings more substantial than those of resident laborers, and the wages of the non-residents include a minimum share of earnings in kind; second, since 1968 the IEA * wage study has not been "objective" (based on questionnaires directed to the agricultural employer), but rather "subjective" (based on responses given by agronomists of the Institute itself, located in the various agricultural sub-regions). There is no apparent reason why the agronomists would falsify the information submitted to the Institute, nevertheless no decline in rural wages after 1967 is observed. Finally, the Statute's effect on rural wages may have been less a function of the minimum wage than the creation of a legal apparatus which supports the demands of rural wage laborers. In order to avoid the action of the "rural legal services lawyers", rural landowners may have chosen to pay wages above the alternative value of labor on small holdings. The pers-

[3] The relevant regression equation is:

$$u = \underset{(1.7)}{76.0} + \underset{(2.7)}{22.2}\ DUM$$

$$R^2 = 0.70; \quad d = 1.33; \quad Se = 7.38$$

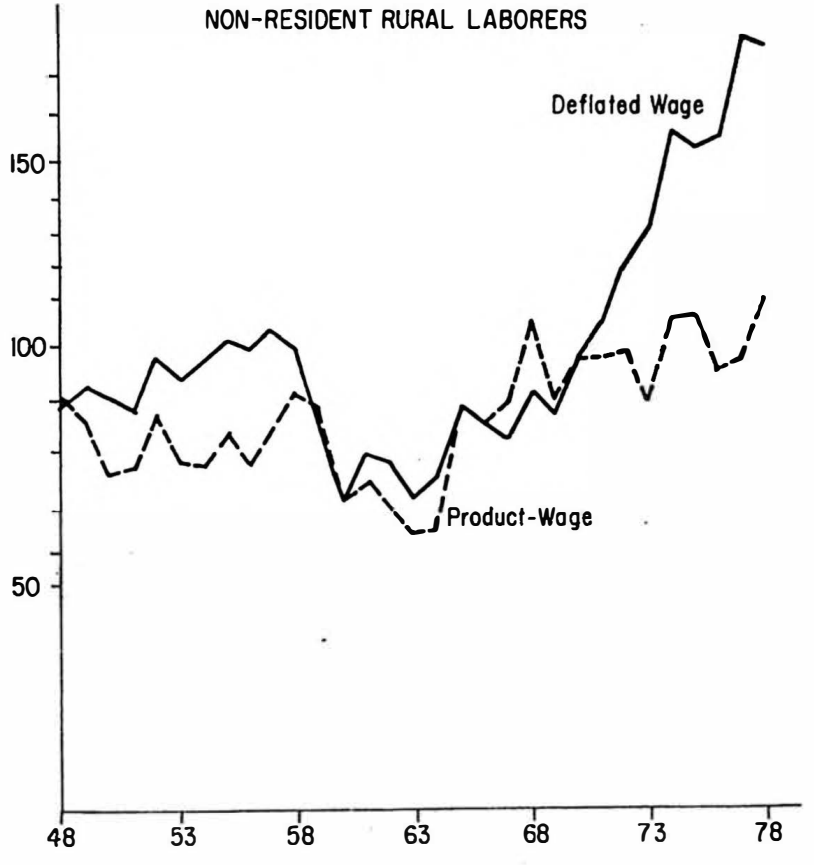
Where u is the product-wage index and DUM is a dummy variable equal to zero in 1948-1966 and equal to 1 in 1967-1978. The numbers in parenthesis are the standard errors of estimate of the regression coefficients. The value of the Durbin-Watson statistic is low, indicating that explanatory variables are missing in the equation, but the statistical test generally supports the description of the text.

* IEA: Instituto de Economia Agrícola — Institute of Agricultural Economics.

[4] P. V. Sendin, "Elaboração de um Índice de Salários Rurais para o Estado de São Paulo", in *Agricultura em São Paulo*, vol. 19, no. 2 (1972), p. 181.

Graph 2

DAILY WAGE INDICES OF NON-RESIDENT RURAL LABORERS IN SÃO PAULO



pective of unemployment in the capitalist form of production thus becomes more costly for the wage laborer, who consequently ceases to demand his "rights" in the recently stablished Labor Courts. In other words, the increase in real rural wages (with a possible decrease in employment) is a form by which the wage labor market adjusts to the increase in the worker's bargaining power resultant of the implementation of the Rural Labor Statute.

The constancy of the product-wage since 1967 is particularly impressive since other analysis (for example, the annual forecasts ("*Prognósticos*") of the *Instituto de Economia Agrícola de São Paulo*) have considered only the behavior of deflated wages. The latter increased by more than 50% during the past decade. Note in Graph 1 that the general trend of the deflated wage declines until 1963, when it reaches a minimum limit, from which wages increase dramatically until 1977-1978. This series' post-1963 behavior can be explained in two stages. From 1963 to 1967, the wage increase seems to have been due to the accomodation of São Paulo agriculture to the new labor legislation. Since 1968, the spectacular increase in agriculture's terms of trade provoked a rural wage increase. The alterations in the terms of trade can be seen in Tables 3 and 4 in Graph 4. The increase in the relative prices of agriculture since 1968 was stimulated from abroad, but the food cost indices in Rio de Janeiro and São Paulo, shown in Appendix 2, also indicate a considerable improvement in the relative position of agriculture for domestic consumption during this period.

It should be emphasized that the increase in the deflated agricultural wages since the mid-1960's was due to the alteration in the terms of trade. It did not imply an increase in the rural wage laborer's purchasing power over his own product. The wage increase can thus be temporary, unless world market conditions result in the setting of a permanently higher level for agricultural prices in Brazil.

The long-run increase in rural wages does not appear to be linked to the trend of increasing productivity of agricultural labor in São Paulo. There are no annual series, but the IBGE agricultural censuses estimate that in 1950, 1960, 1970 and 1975 the agricultural labor force of São Paulo was composed of 1.5, 1.7, 1.4 and 1.5 million people, respectively. (The *Instituto de Economia Agrícola de São Paulo* disagrees with this last estimate and, in an unpublished document, suggests that the rural labor force in 1975 was composed of 1.3 million people; this number includes resident and day laborers). There is also an index available of the real value of rural production in São Paulo, prepared by the Instituto de Economia Agrícola. [5] Assuming that the number of hours worked per employee is constant, we can calculate a productivity index of rural labor in São Paulo for the years of the censuses. Table 1 presents this index, together with the product-wage index for the key years.

5 The production series of the IEA in current prices includes 21 commodities, the same which appear in the price series of Table 3. The index of real production is the result of the division of the production value series by the price index series.

Between 1950 and 1960, rural wages icreased by only 2.5%, while the rural labor productivity rose by 26% during the same period. Between 1960 and 1970, wages rose nearly as much as productivity but, as was previously observed, the wage increase was caused by the introduction of rural labor legislation. In compensation, labor productivity should have increased much more uniformly during the period. Between 1970 and 1975, wages increased by 5%, while productivity either remained constant (according to the estimate of the IBGE regarding the labor force) or rose by 15% (according to the IEA estimate).[6] No definitive conclusion regarding this period may be drawn, given the uncertainty of the available information.

In brief, an institutional phenomenon (the Rural Labor Statute) appears to explain the sudden increase in the product-wage series. Were it not for this, one could propose the hypothesis that rural wages would have remained constant at the level of productivity of family farming in the country.

One doubt remains: how can wages rise when agricultural prices increase and, at the same time, remain constant when productivity increases? If the labor supply were fixed, this would certainly contradict the theory of labor demand. Nevertheles, the prevalence of pre-capitalist modes of employment in Brazil gurantees an unlimited supply of labor to capitalist agriculture. In this context, an increase in agricultural prices increased rural wages, because it also increased the value of labor-time in small-scale farming. But the technical change which increases the productivity of labor in capitalist agriculture maintains the rural wage constant if it does not affect the level of productivity of family farming. Technical progress also may not increase capitalist rural employment if such employment is limited by considerations linked not to the marginal productivity of labor, but by demand restrictions in the commodity market, as some Brazilian economists believe to be the case.[7] We therefore conclude that market forces may not transfer the benefits of agricultural modernization to rural laborers, unless it also reaches the family farmer.

The empirical results are amply supported by the behavior of the wage series of non-resident rural laborers in São Paulo (see Graph 2). The principal difference is that temporary laborers, due

[6] It should be noted that 1975 was the year in which the product-wage reached its maximum value. An average of three years, with 1975 being the middle year, produces an average wage slightly lower than that which prevailed in 1970.

[7] Ruy Miller Paiva, "Modernização e Dualismo Tecnológico na Agricultura", in *Pesquisa e Planejamento*, vol. 1, no. 2 (December, 1971), pp. 171-234, and "Modernização e Dualismo Tecnológico na Agricultura: Uma Reformulação", in *Pesquisa e Planejamento Econômico*, vol. 5, no. 1 (June, 1975), pp. 117-162.

to their greater mobility, earn relatively more than permanent laborers since 1968, with the increase in agricultural prices. A wage pattern similar to that of the permanent laborer is that of tractor operators in São Paulo (Table 2).

3 — Urban wages

While rural wages, in terms of product, followed a straight forward time trend, the wages of unskilled urban labor behaved in a much more complex fashion in the period under examination. Graph 3 indicates the median wages trends in the industrial sector of Rio de Janeiro from 1952 to 1973.[8] Two wage concepts were utilized. The product-wage is the monetary wage divided by the wholesale price index, calculated by the Fundação Getulio Vargas for industrial products. Real wages are equal to the quotient between monetary wages and a food cost index for Rio de Janeiro.[9]

Despite some statistical pitfalls, which are discussed in Appendix 1, the median wage series seems to be a more appropriate wage index for unskilled urban labor than the minimum wage or average industrial wage.

In another study, we argue that the behavior of the median wage in the Rio de Janeiro industry could be explained by the trends of the official minimum wage, GDP *per capita* and the cost of living index calculated by the Fundação Getulio Vargas for Rio de Janeiro.[10] The elasticity of the median wage in relation to the minimum wage was estimated at 0.5, while the elasticities in relation to the price level and to the proxies used for productivity were calculated at 0.3 and 0.2, respectively. These results confirm that the minimum wage was important in the determination of the wage level of unskilled urban labor and also indicate a wage drift in the period under examination, preventing the market wages from falling as much as the mininum wage during the 1960's. Thus, to a certain degree the minimum wage overestimates, the effects

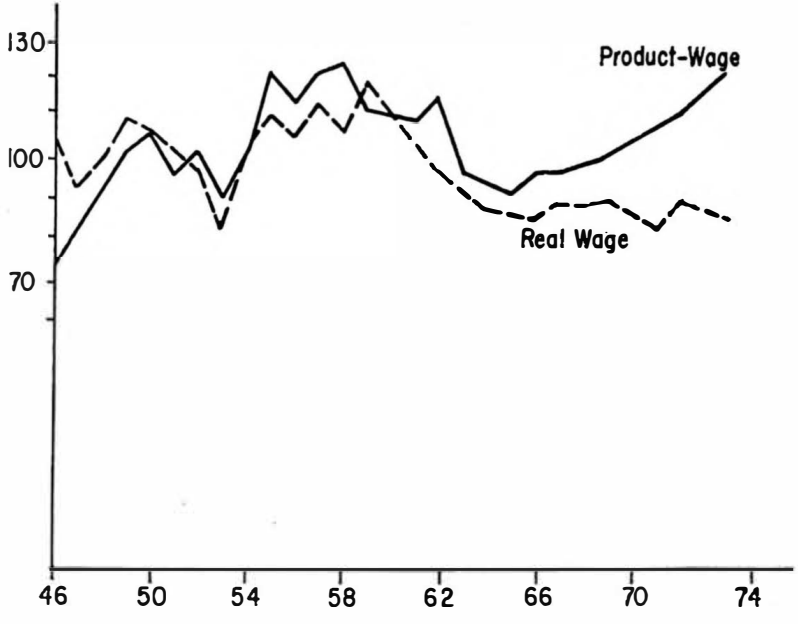
[8] Three different sources were used to calculate this wage series for the 22-year period (for statistical details, see Appendix 1). For lack of data, we were unable to utilize either the modal wage or the wage of unskilled labor in the industry of São Paulo. Median wages for the industrial sector of Rio de Janeiro are not available after 1973. The wages in graph 3 do not include the 13th monthly wage, in effect since 1962.

[9] For the period 1952-1956, the cost of food products were obtained from the FGV cost of living index for Rio de Janeiro. The values for 1967-1973 are our own estimates, presented in Appendix 2.

[10] Edmar L. Bacha and L. Taylor, "Brazilian Income Distribution in the 1960's: "Facts, Model Results and the Controversy", in *The Journal of Development Studies*, vol. 14, no. 3 (April, 1978), pp. 271-297.

Graph 3

INDICES OF MONTHLY MEDIAN WAGES IN THE INDUSTRIAL SECTOR OF RIO DE JANEIRO (1954 = 100)



of the post-1964 wage squeeze on the earnings of unskilled urban workers.

In two previous studies we argue that average urban wages constitute a weak index of the wage level of unskilled labor. [11] In "Emprego e Salários na Indústria de Transformação, 1949-1969" we showed that average industrial wages in terms of industrial prices, increased by 95.7% between 1949 and 1969, whereas the average wages of workers rose by 66.3% in the same period. In "Hierarquia e Remuneração Gerencial", the analysis of a sample of large industries in the Center-South region of Brazil revealed that the real

[11] Milton da Mata and Edmar L. Bacha, "Emprego e Salários na Indústria de Transformação, 1949-1969", in *Pesquisa e Planejamento Econômico*, vol. 3, no. 2 (June, 1973), pp. 303-340, and Edmar L. Bacha, "Hierarquia e Remuneração Gerencial", in *Estudos Econômicos*, vol. 4, no. 1 (1974), pp. 142-176, both reproduced in *Os Mitos de Uma Década* (Rio de Janeiro: Paz e Terra, 1976), pp. 67-74 and 107-134), respectively.

wages of unskilled workers decreased by 8% between 1966 and 1972, whereas, in the same period, the wages of skilled workers rose by 20% and those of managers rose by 52%.

The continuous trend toward the concentration of income distribution in the urban sector in Brazil, which emerges from the examination of these and other data, [12] prevents the utilization of the average wage as an approximation of the wage level of unskilled urban workers in Brazil in the post-World War II period.

The long-run behavior of the median wage appears reasonably compatible with the predictions of Lewis' model. In the period 1946-1973, the real wage fluctuated cyclically, with a declining trend between the 1950's and 1960's. However, when the 13th monthly wage is considered, (this policy was initiated in 1962), the average difference in wage levels between the 1950's and 1960's declined, and on a long-run basis, the urban wage in terms of food prices is relatively constant. [13]

This result was conditioned by the interaction of the urban political struggle with the trend in the terms of trade of the agricultural sector. With the introduction of minimum wage legislation in January, 1952, the populist policy, together with a decrease in the relative agricultural prices, brought about an increase both in product-wage and in real wages until 1958-1959. There followed a period of rapidly increasing inflation and increase in agricultures terms of trade. In terms of industrial prices, wages reached a maximum value in 1962 (when taking into consideration the 13th monthly wage, which was first implemented in December of that year), but in real terms wages followed a continuously downward course since 1959.

[12] For references see Edmar L. Bacha and L. Taylor, *op. cit.*

[13] The results of regressions are the following: when real wages are measured excluding the 13th monthly wage, we get:

$$v = \underset{(17.2)}{101.2} - \underset{(2.7)}{10.2}\ SHIFT$$

$$R^2 = 0.38;\quad d = 1.35;\quad Se = 6.65$$

where v is the index of real median wages (1969-1971 = 100) and *SHIFT* is a dummy variable equal to zero in 1946-1961, and equal to 1 in 1962-1973. The estimate of the variable coefficient *SHIFT* decreases in value and becomes statistically non-significant when the 13th monthly wage is added to the monthly wage:

$$v^* = \underset{(17.5)}{101.2} - \underset{(2.78)}{2.55}\ SHIFT$$

$$R^2 = 0.04;\quad d = 1,34;\quad Se = 6.78$$

where v^* is the index of real median wages, including the 13th monthly wage since 1962.

The rising price and wage spiral was drawn to a halt only in 1964, with the advent of a Federal Administration which banned labor union activity and discontinued minimum wage legislation. Inflation was then brought under control and real wages continued to decline until 1966, after which time the wage level remained constant until the end of the period.[14]

The continuing decrease in real wages and the maintenance of their value at a relatively low level took place in an authoritarian political context. It may thus be concluded that the long-run stability of urban wages was the result of a political cycle, rather than of the type of labor market adjustments considered in the literature on the dual growth model. In the following section, we discuss these themes further, first considering the trend in the ratio between urban and rural wages.

4 — Relation between urban and rural wages

Graph 4 presents an estimate of the trend of the differential between urban and rural wages in the South of Brazil during the post-World War II period. The rural wage is equivalent to 30 days wages of the resident day laborer, shown in Graph 1, while the urban wage is composed of two parts. For the period 1948-1973, the data were derived from the median industrial wage of Rio de Janeiro in Table 5 (applying a geometric process of interpolation to centralize the observations for 1965-1973 in June of each year) The average hourly wage of bricklayers in the construction industry in Brazil (shown in Appendix 2) was then linked to this series of the median wage to complete the information for the period 1974-1977.

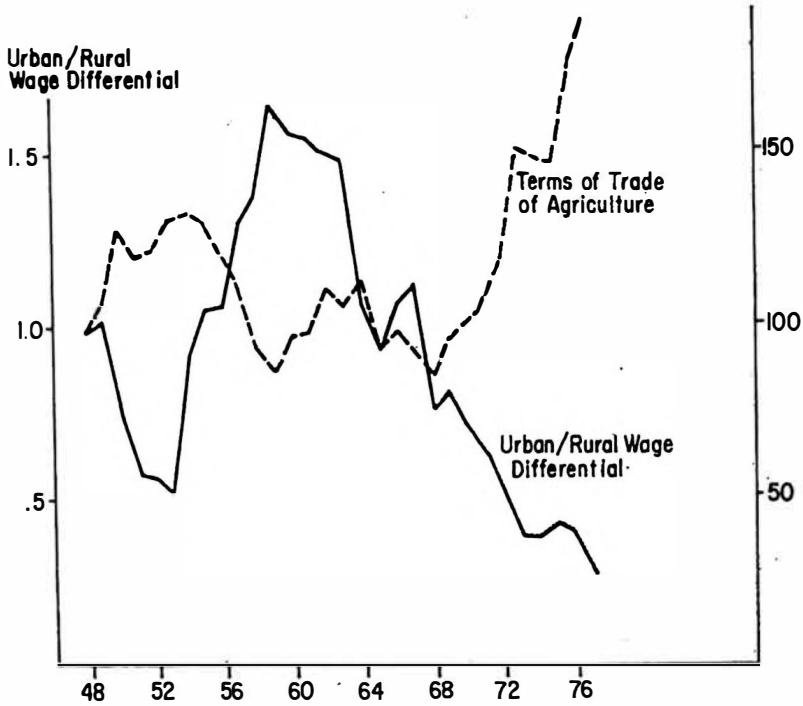
If the differential between urban and rural wages in equilibrium conditions is 30%, as Lewis suggests,[15] in agreement with Graph 4, this equilibrium began to prevail in Brazil only very recently. In the late 1940's, the differential between urban and rural wages was approximately 100%. It fell to 50% at the beginning of the following decade and then increased to 150% in the late 1950's and the early 1960's. Henceforth, it fell regularly throughout the 1960's and 1970's, until it reached 28% in 1977.

[14] The behavior of the wage of unskilled urban labor after 1973 can be obtained from a wage series for the construction industry, published by the IBGE. According to this series, the real wage began to rise slowly in 1973, but did not reach the 1969 level until 1977 (for details, see Appendix 2). Adding this evidence to Graph 3, it can be said that the basic urban wage has remained practically constant in real terms since 1966.

[15] W. Arthur Lewis, *op. cit.*

Graph 4

URBAN/RURAL WAGE DIFFERENCIAL AND AGRICULTURAL TERMS OF TRADE

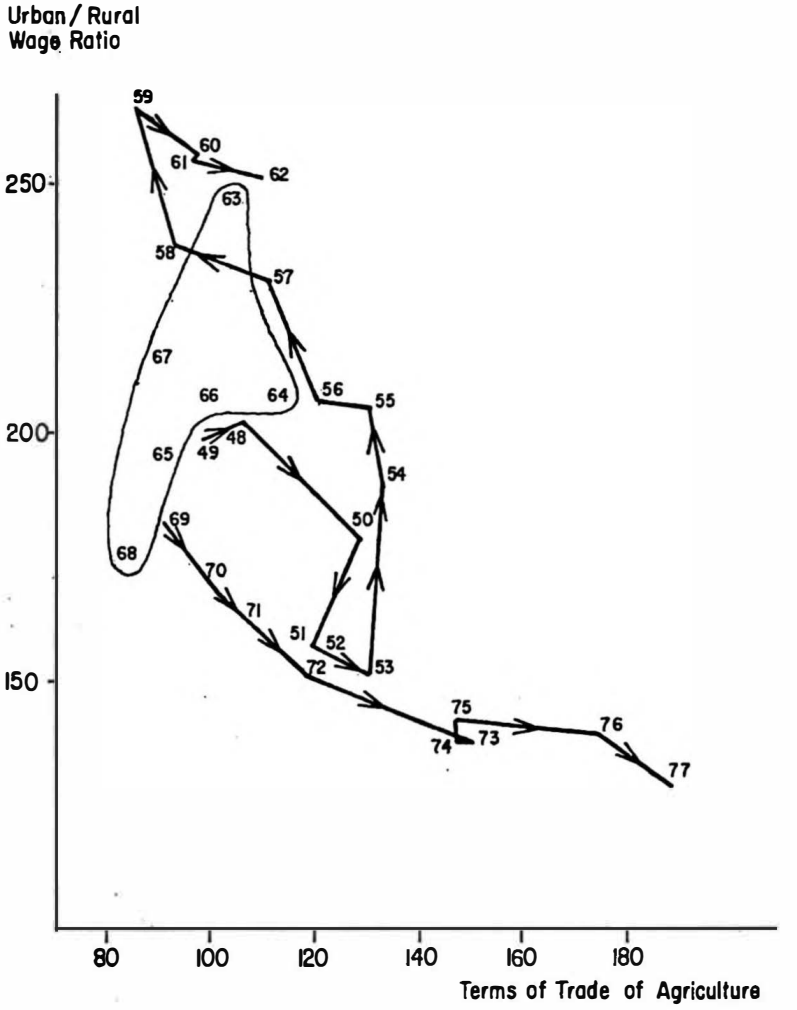


Graph 4 also indicates that the terms of trade of agriculture is closely associated with the wage differential. The relation between these two variables is clearly presented in Graph 5. Three periods can be identified: 1948-1962, 1963-1968 and 1969-1977. The sensitivity of the wage ratio to the trade balance is stronger during the the first period. There is no relation between the variables from 1963 to 1968, but the relation reappears in the period 1969-1977, with the wage ratio being much less sensitive to the terms of trade than previously.

There is little doubt that institutional phenomena were responsible for the decline in the differential between urban and rural wages in 1963-1968, a period during which the terms of trade of agriculture followed a declining trend. On the one hand, the labor

Graph 5

WAGE RATIO AND THE TERMS OF TRADE-1948/1977



policy adopted after 1964 compressed the urban minimum wage. On the other hand, rural wages rose due to the extension of labor legislation to the rural sector since 1963. The combined effect of these policies resulted in a substantial reduction in the differential between urban and rural wages.

The negative relation between the terms of trade of agriculture and the ratio between urban and rural wages for the other two periods on the graph can be explained if we accept the fact that the wage share in the urban sector is fixed institutionally by collective bargaining between workers and capitalists, under the aegis of the State. The monetary wage in the rural sector is determined by the value of average labor productivity in small-escale agriculture. An increase in the ratio between the prices of rural and urban commodities should lead, then, to a decline in the ratio between urban and rural wages. But if this is correct, what is the explanation for the sharp drop in the sensitivity of the wage ratio with respect to sectoral terms of trade between 1948-1962 and 1969-1977? Three hypothesis can be raised.

The first stresses the institutional phenomena, denying the causal validity of the relation presented in Graph 5. In accordance, with this view, the wage differential increased during the 1950's because the Government was populist and urban unions were relatively strong. It declined in the 1960's and 1970's because the Government was authoritarian and unions were weak. The changes in the terms of trade were incidental to these political changes, and its relation to the wage differential was fortuitous.

This hypothesis states that the level and the rate of growth of the ratio between urban and rural wages is a function of political factors. If the latter were represented by dummy variables, a possible econometric test of the hypothesis is provided by:

$$ln\ w = \underset{}{4.11} + \underset{(.0142)}{.0639t} + \underset{(.81)}{2.85\ D} - \underset{(.034)}{.183\ D.t}$$
$$\qquad\qquad (.13)$$

$$R^2 = .82;\quad d = .73;\quad Se = .24$$

were $ln\ w$ is the natural log of the index of the ratio between urban and rural wages, t is time and D a dummy variable equal to zero in the period 1948-1962 and equal to 1 in the period 1969-1977 (the observations for 1963-1968 were excluded from the equation for previously stated reasons). The numbers in parenthesis are the standard errors of the regression coefficients.

The rate of variation of the wage ratio behaves as was predicted by the institutional hypothesis: it is positive and equal to 6.4% annually in the first period and negative and equal to

11.9% annually in the second period. However the low value of the Durbin-Watson coefficient indicates the existence of serial correlation in the residuals and, therefore, the lack of additional explanatory variables in the regression equation. Politics can explain some but not all of these wage movements.

A second hypothesis, although it accepts the effect of the terms of trade on the wage ratio, argues that one variable is missing from the graph: the growth rate of labor productivity in the urban sector. In the first period (1948-1962), the productivity factor tended to widen the wage differential, and the terms of trade had the same effect. Consequently, the effect of the latter was amplified by the exclusion of the productivity variable. On the other hand, during the 1970's the terms of trade in agriculture tended to reduce the wage differential, whereas the productivity factor acted in the opposite direction. Thus, the exclusion of the productivity variable is responsible for an underestimate of the effects of the terms of trade on the wage differential during the 1970's.

Assuming that the productivity of urban labor is an exponential fuction of time, the second hypothesis can be represented econometrically by the equation:

$$\ln w = \underset{(1.6)}{13.1} - \underset{(.35)}{1.80} \ln P - \underset{(.0072)}{.047t}$$

$$R^2 = .70; \quad d = .81; \quad Se = .302$$

where P represents the terms of trade of agriculture and the other symbols are the same as in the previous equation.

Contrary to the hypothesis, the coefficient of the proxy for productivity is negative: the ratio between urban and rural wages decreases over time.

The sign of the coefficient of the time variable plus the fact that urban wages were higher than rural wages at the beginning of the period indicate that there was an adjustment mechanism which tended to reduce the wage differential.

A third hypothesis takes into consideration the existence of this adjustment mechanism and attempts to explain the reduction in the sensitivity of the wage ratio to the terms of trade in terms of more rapid rates of intersectorial mobility on the part of labor. An indicator of this phenomenon could be the expansion of seasonal labor in agriculture, that is, people who work jobs alternately in the rural and urban sectors, depending on the opportunities available. This is a consequence of the penetration of purely capitalist production into the rural sector, causing a leveling trend in the wage rate, regardless of the economic sector.

The econometric implications of this hypothesis are that the ratio between urban and rural wages at time t is negatively dependent on the agricultural terms of trade, positively dependent on the growth of the (relative) productivity of urban labor, and negatively dependent on the wage ratio at time t-1.[16] The greater the wage ratio at time t-1, the more rapidly labor will migrate from rural to urban occupation, and this will tend to reduce the wage ratio in time t. If the hypothesis is correct, the coeficient of the wage ratio entered in lag form would increase in absolute terms between 1948-1962 and 1969-1977 (the same would occur to the intercept, as demonstrated in note 16).

The estimated equation is:

$$\begin{aligned} ln\ w = {} & 9.62 + .11\ D - .388\ lnP + .0271t - .502\ lnw_{-1} \\ & (2.00)\quad (2.29)\quad (.253)\quad (.0059)\quad (.518) \\ & - .151\ D.lnw_{-1} \\ & (0.437) \end{aligned}$$

$$R^2 = .92;\quad d = 1.14;\quad Se = .077$$

Whe w_{-1} is the value of the lagged wage ratio.

All the signs are as predicted, although the standard errors are quite large.[17] Furthermore, Durbin's test for autocorrelation, in

[16] We write the wage ratio as a negative function of the terms of trade and as positive function of the relative productivities of labor:

$$w = AP^a\ Q^b\ L^{-b}\quad a < 0,\quad b > 0$$

were Q is a ratio between urban an rural production and L is the ratio between rural and urban employment. We measured migration as the ratio between L and L_{-1}, and we assume that it is a function of the differential between the wage ratio in time t_{-1} and the wage ratio in equilibrium conditions, w^*:

$$L/L_{-1} = B\,(w_{-1}/w^*)^c,\quad c > 0$$

Let:

$$K = AB^{-b}\ w^{*bc}$$

and we assume (for lack of data on Q and L_{-1}) that:

$$(Q/L_{-1})^b = e^{ht},\quad h > 0$$

Then, substituting the equation for L in the formula of w and simplifying, we obtain an equation which can be estimated:

$$w = KP^a\ e^{ht}\ w_{-1}^{bc}$$

A greater mobility of labor can be specified as an increase in the value of c, thus increasing both the value of the constant term, k, as well as the absolute value of the coefficient of w_{-1}.

[17] In a comparison with the previous equation, the inversion of the sign of the coefficient of the variable time is particularly interesting. Tbis change justifies the theoretical expectation on the sign of this coefficient.

the presence of the value of the lagged dependent variable between the regressors, indicates a serial correlation in the residuals.

Thus, our preliminary econometric tests do not provide sufficient information to distinguish among the alternative hypothesis which were raised. Nevertheless, they indicate the importance of relative prices and political variables and lend some credibility to the third hypothesis according to which the increasing mobility of labor tends to diminish the effect of the terms of trade on the ratio between urban and rural wages.

5 — Conclusions

Our tentative findings bring us to a rather somber conclusion: despite the spectacular increase in Brazil's *per capita* GDP following World War II, in terms of food, median urban wages are no greater and probably lower today than they were 30 years ago. In terms of basic needs, it appears that unskilled urban workers as a functional group, in no way benefited from the fact that *per capita* income in the country more than tripled in the period under examination.

The agricultural wage earner in the South of Brazil has benefited from the extension of labor legislation to the rural sector since 1963. With the exception of this improvement, and despite significant increases in productivity in the agricultural sector, in terms of agricultural product, rural wages remained relatively constant during these 30 years.

One can ask wthether this was a necessary consequence of the surplus labor condition which predominated at the beginning of the post-World War II period. The answer seems to be negative, for two independent reasons.

First, an agrarian reform program allowing for agricultural modernization under a family farming system would have forced an increase in the wages of unskilled labor both in capitalist agriculture and urban occupations. Second, apparently for most of the period under examination, the intersectorial mobility of labor was not sufficiently strong to tie urban wages to rural income. Aside from the terms of trade, the level of urban wages appears to have depended more on the political force of the urban proletariat than on anything else

Our results indicate that it would be improper to adopt a fatalist attitude with regard to the labor surplus. The Government's policy (minimum wage legislation in particular) is an important determinant of the wage increases for unskilled workers. The effectiveness of this legislation would have been greater if it had been

accompanied by political measures intended to increase the productivity of small farms, which could be accomplished through an advanced program of agrarian reform.

Appendix 1 — Statistical data

This appendix consists of six tables which contain the data discussed in the text.

Table 1 reports the evolution of the productivity of agricultural labor and agricultural wages in São Paulo for 1950-1975. The construction of these indexes is explained in the text.

Table 1

São Paulo: Productivity of Agricultural Labor and Rural Wages in Selected Years for 1950/1975

Years	Index of Labor Productivity	Product-Wage Index
1950	58.2	75.5
1960	73.4	77.4
1970	100	100
1975	101 (115)	105

SOURCE: IBGE; Instituto de Economia Agrícola de São Paulo (unpublished data); and Table 2.
NOTES: The index of labor productivity agrees with the estimates calculated by the IBGE for the agricultural labor force (agricultural censuses). The number in parenthesis was obtained using the estimate of the *Instituto de Economia Agrícola* for the labor force in 1975.

Table 2 presents the series for rural wages in São Paulo. The data for 1948-1970 were taken from the study by Sendin, [18] who, during the period 1968-1969, surveyed aproximately 20 cattle ranches in São Paulo which had kept book-keeping records since 1948. Since 1962, to this information Sendin added data from the annual "Prognósticos" published by the *Instituto de Economia Agrícola de São Paulo* for the agricultural season. The annual wage data since 1968 were obtained by taking the average wages for March and November of each year, collected by the local agencies of the IEA and published in the annual "Prognósticos" obviously the more recent information is more trustworthy.

[18] P. V. Sendin, *op. cit.*, pp. 167-190.

The wage data was deflated by using the two prices series in Table 3. The series of prices received by São Paulo growers is an index published in *Conjuntura Econômica,* but collected by the IEA. It is a Laspeyres index for the 21 most important agricultural commodities of São Paulo. At least for the more recent period, the weight for this index were derived from the average quantities produced in the period 1962-1966. The aggregate price index is a combination of the general price index of the FGV (column 2 of *Conjuntura Econômica*) for 1948-1964 and April, 1978, with the price deflator of the GNP for the period 1965-1967. We avoided using the FGV general price index during the 1970's because its calculation involved the computation of the cost of living in Rio de Janeiro, the wholesale price index and the construction cost index in Rio de Janeiro, and we suspect that neither of these reflects the true price trend for this period. [19]

Table 4 shows the estimates for the terms of trade of agriculture. The series of prices received by São Paulo growers, from Table 3, in the numerator. The denominator is the wholesale price index calculated by the FVG for the industrial sector (column 18 of *Conjuntura Econômica*). This latter index probably also underestimates the industrial price trend in the country, as Bonelli pointed out, [20] but unfortunately no other series was available.

Table 5 contains median monthly wage estimates in the industrial sector of the City of Rio de Janeiro. The annual averages for 1949-1956 were obtained in *Conjuntura Econômica,* vol. 12, no. 1 (January, 1958). It is a wage index calculated by the former Center for Social Studies of the Fundação Getulio Vargas, based on a sample of 177 industrial establishments. The estimates for April 1957 through April 1963 are found in the *Anuários Estatísticos do Brasil,* of the IBGE, and refer to the median wage in establishments having five or more employees in the former State of Guanabara. Bacha, da Mata and Modenesi [21] present an argument showing that the two previous series are resonably compatible. The estimates for April 1965 to April 1973 were obtained by linear interpolation from the wage distribution for the industrial sector of Rio de Janeiro. The information is taken from questionnaires completed under the Law of the 2/3, which was published annually by the

19 For an examination of this problem, see Instituto dos Economistas do Rio de Janeiro, *Boletim* (October, 1978).

20 Regis Bonelli, "Mais Dificuldades na Interpretação dos Dados da Indústria", in *Pesquisa e Planejamento Econômico,* vol. 8, no. 2 (August, 1978), pp. 505-524.

21 Edmar L. Bacha, Milton da Mata and Rui Lyrio Modenesi, *Encargos Trabalhistas e Absorção de Mão-de-Obra: Uma Interpretação do Problema e seu Debate, Coleção Relatórios de Pesquisa* (Rio de Janeiro: IPEA/INPES, 1972), no. 12.

Table 2

São Paulo: Rural Wage — 1948-1978

Years	Resident Day Laborers			Non-Resident Day Laborers			Resident Tractor Operators		
	Monetary Wage[a]	Deflated Wage[b]	Product-Wage[c]	Monetary Wage[a]	Deflated Wage[b]	Product-Wage[c]	Monetary Wage[a]	Deflated Wage[b]	Product-Wage[c]
1948	0.016	80.2	77.9	0.020	88.7	91.2	0.020	84.3	82.0
49	0.018	84.3	77.3	0.022	93.7	85.9	0.022	86.7	79.5
1950	0.022	92.8	75.5	0.024	92.2	75.0	0.025	88.7	72.1
51	0.027	97.6	83.5	0.027	88.8	76.0	0.029	88.3	75.5
52	0.031	100	87.9	0.034	100	87.8	0.035	95.3	83.5
53	0.033	93.0	75.3	0.037	94.9	76.8	0.038	90.1	72.9
54	0.039	84.4	64.8	0.049	99.0	76.1	0.042	78.4	60.3
55	0.047	89.6	72.0	0.060	104	83.5	0.52	83.4	67.0
56	0.055	87.7	73.3	0.063	91.8	76.7	0.063	84.4	70.5
57	0.063	87.9	77.8	0.076	86.4	85.4	0.071	82.9	73.4
58	0.070	86.1	87.2	0.082	91.8	92.9	0.078	81.0	82.1
59	0.087	77.5	82.8	0.103	83.5	89.2	0.100	75.2	80.4
1960	0.114	79.0	77.4	0.110	69.4	67.9	0.138	80.4	78.7
61	0.148	74.8	70.7	0.171	78.7	74.4	0.174	74.0	70.0

62	0.223	74.3	64.5	0.254	77.1	66.9	0.261	73.1	63.4
63	0.362	69.0	60.7	0.398	69.0	60.7	0.427	68.5	60.3
64	0.764	76.4	63.9	0.814	73.8	61.8	0.904	75.9	63.5
65	1.37	87.3	88.1	1.55	89.5	90.4	2.08	111	112
66	1.78	81.0	80.7	2.07	85.7	85.3	2.45	93.9	93.5
67	2.49	83.0	98.0	2.54	81.8	91.1	2.89	86.0	95.7
68	3.29	91.0	106	3.70	93.2	108		84.5	98.3
69	3.97	91.3	94.1	4.16	87.0	89.8	4.76	92.1	95.0
1970	5.14	100	100	5.65	100	100	6.11	100	100
71	6.45	107	100	7.04	107	100	7.80	109	102
72	8.38	118	101	9.36	120	102	9.16	109	92.6
73	11.35	133	93.6	11.90	127	89.4	12.55	123	86.9
74	15.85	141	103	18.25	148	108	16.77	126	91.9
75	20.65	139	105	23.75	145	109	22.97	130	97.9
76	27.85	133	86.7	34.05	147	96.5	30.89	124	81.0
77	45.20	151	93.4	52.50	159	98.7	47.73	124	83.0
78	52.40	136	97.6	66.10	156	112.1	59.78	130	93.7

3.63

SOURCES: P.V. Sendin, *op. cit.*; and Instituto de Economia Agrícola de São Paulo, *Prognóstico*, 1978 and 1979.

[a] In cruzeiros (Cr$) per day.

[b] Monetary wages/aggregate price index, 1970 = 100.

[c] Monetary wages/prices received by São Paulo growers, 1970 = 100.

Table 3

Brazil and São Paulo: Indices of Selected Prices for 1948-1978

(1970 = 100)

Years	General Price Index linked to the Implicit Deflator of the GDP (1)	Prices Received by São Paulo Growers (2)	Index of the Terms of Trade of Agriculture (100 × (2)/(1))
1948	0.388	0.399	103
1949	0.415	0.453	109
1950	0.461	0.567	123
1951	0.539	0.629	117
1952	0.601	0.686	114
1953	0.690	0.853	124
1954	0.876	1.14	130
1955	1.02	1.27	125
1956	1.22	1.46	120
1957	1.40	1.58	113
1958	1.59	1.56	98.7
1959	2.18	2.04	93.6
1960	2 81	2.87	102.1
1961	3.85	4.07	105.7
1962	5.84	6.73	115.2
1963	10.2	11.6	113.7
1964	13.5	23.3	119.5
1965	30.6	30.3	99.0
1966	42.7	42.9	100
1967	55.0	49.4	89.8
1968	70.3	60.4	85.9
1969	84.6	82.0	96.9
1970	100.	100	100
1971	117	125	107
1972	138	162	117
1973	166	236	142
1974	218	298	137
1975	290	384	132
1976	409	625	153
1977	584	941	161
April 1978	750	1 044	139

SOURCES: FGV, *Conjuntura Econômica;* P.V. Sendin, *op. cit.;* IEA, *op. cit.*

Table 4

Central South Region of Brazil:
Terms of Trade of Agriculture for 1948/1978

(1970 = 100)

Years	Wholesale Prices of the Industrial Sector	Terms of Trade of Agriculture = Prices Received by São Paulo Growers/Wholesale Prices of the Industrial Sector
1948	0.406	98.3
1949	0.425	107
1950	0.441	129
1951	0.524	120
1952	0.563	122
1953	0.651	131
1954	0.856	133
1955	0.969	131
1956	1.21	121
1957	1.41	112
1958	1.66	94.0
1959	2.38	85.7
1960	2 93	98.0
1961	4.17	97.6
1962	6.07	111
1963	11.1	105
1964	20.3	115
1965	32.8	92.4
1966	43.4	98.8
1967	54.6	90.5
1968	71.2	84.8
1969	85.6	95.8
1970	100	100
1971	117	107
1972	136	119
1973	156	151
1974	202	148
1975	262	147
1976	357	175
1977	497	189
April 78	626	167

SOURCE: FGV, *Conjuntura Econômica.*

Table 5

City of Rio de Janeiro: Monthly Median Wages of Employees in the Industrial Sector for 1948/1972

Dates	Median Wage		Wholesale Prices of the Industrial Sector (1970 = 100)	Cost of Food Products in Rio de Janeiro (1970 = 100)	Product-Wage (2)/(3)	Real Wage (2)/(4)
	Cr$ per Month	Index With 1969–74 = 100				
	(1)	(2)	(3)	(4)	(5)	(6)
1946	0.789	0.305	0.409	0.290	74.6	105
1947	0.865	0.335	0.405	0.363	82.7	92.3
1948	0.950	0.368	0.406	0.381	90.6	96.6
1949	1.09	0.422	0.425	0.400	99.3	106
1950	1.17	0.453	0.441	0.435	103	104
1951	1.27	0.491	0.524	0.491	93.7	100
1952	1.45	0.561	0.563	0.592	99.6	94 8
1953	1.49	0.576	0.661	0.697	88.5	82.6
1954	2.19	0.847	0.856	0.844	98.9	100
1955	2.89	1.12	0.969	1.05	116	107
1956	3.40	1.32	1.21	1.30	109	102
4/1957	4.27	1.65	1.42	1.51	116	109
4/1958	4.69	1.81	1.53	1.76	118	103
4/1959	6.63	2.56	2.36	2.27	108	113
4/1961	10.69	4.10	3.87	4.03	106	102
4/1962	15.49	5.99	5.41	6.30	111	95.1
4/1963	24.59	9.51	10.0	10.4	95.1	91.4
4/1965	75.05	29.0	32.0	33.3	89.5	87.1
4/1966	102.70	39.7	41.0	46.8	94.7	84.8
4/1967	131.00	50.6	53.3	57.4[a]	94.9	88.2
4/1968	169.50	65.6	68.1	67.2[a]	96.3	97.6
4/1969	208.80	80.8	82.5	81.3[a]	97.9	99.4
4/1971	308.20	119	113	128 [a]	105	93.0
4/1972	365.80	141	132	158 [a]	107	89.2
4/1973	453.40	175	175	207 [a]	116	84.5

SOURCES: Median Wages: for 1946–1956, FGV, *Conjuntura Econômica* (January, 1958), for 1957–1963, IBGE, *Anuário Estatístico*, for 1965–1973, Ministério do Trabalho, "Law of the 2/3"; wholesale prices: FGV, *Conjuntura Econômica*; costs of food products: for 1946–1966, FGV, *Conjuntura Econômica*, for 1967–1973, Appendix 2.

[a] Estimates.

Table 6

Central South Region of Brazil: Approximate Urban and Rural Wage Differentials for 1948-1977

Years	Median Monthly Urban Wage (1)	Thirty Days Wages of a Resident Rural Day Laborer in São Paulo (2)	Urban/Rural Wage Differential [(1) — (2)] /(1)
1948	0.950	0.480	97.9
1949	1.09	0.540	102
1950	1.17	0.660	77.3
1951	1.27	0.810	56.8
1952	1.45	0.930	55.9
1953	1.49	0.990	50.5
1954	2.19	1.14	92.1
1955	2.89	1.41	105
1956	3.40	1.65	106
1957	4.34	1.89	130
1958	4.97	2.10	137
1959	6.89	2.61	164
1960	8.72	3.42	155
1961	11.30	4.44	154
1962	16.70	6.69	150
1963	27.00	10.9	148
1964	47.20	22.9	106
1965	79.10	41.1	92.5
1966	110	53.4	106
1967	158	74.7	112
1968	172	98.7	74.3
1969	216	119	81.5
1970	262	154	70.1
1971	317	194	63.4
1972	379	251	51.0
1973	469[a]	341	37.5
1974	657[a]	476	38.0
1975	879[a]	620	41.8
1976	1 163[a]	836	39.1
1977	1 736[a]	1 356	28.0

SOURCES: See text.

[a] Estimates.

Ministry of Labor. The data from the "Law of the 2/3" questionnaires are not based on a fixed sample of companies; therefore, comparability between time periods is dubious. Furthermore, there is no way to check the degree of compatibility between these series and the two previous series.

The wholesale price index for the industrial sector is the index from column 18 of *Conjuntura Econômica*. Food costs for the period 1949-1966 were obtained from the FGV's cost of living index for Rio de Janeiro published in *Conjuntura Econômica*. The estimates for 1967-1973 were derived from retail food prices, collected monthly by the IBGE in Rio de Janeiro, since 1967. Twenty-three food commodities were considered with weights derived from a minimum cost diet.[22] Although observations relating to wages are from April of each year, the estimates of food prices were computed as an annual average. For the linking of the two food price series, we used the ratio between the annual averages of the two 1967 indices.

Table 6 shows the trend of the differential between urban and rural wages. The median monthly urban wage was partially obtained from Table 5. The observations relating to the period from April 1957 to April 1972 were calculated in June of each year, through a geometric process of interpolation. The observations for 1973-1977 were estimated from the annual averages of the hourly wages of bricklayers in the Brazilian construction industry. This index is found in Appendix 2 and was prepared using information published in *Indústria de Construção*, of the IBGE. For the linking of the two series, we proceeded in the following manner: first, we extrapolated the median monthly wage from April of 1973 to June 1973, using the growth factor observed in these series between April 1972 and April 1973; then, we used the ratio between the median industrial wage in June 1973 as a constant multiplier to join the two series.

The rural wage in Table 6 is the same series shown in Table 2 multiplied by 30 to convert the daily wage into a monthly wage.

Appendix 2 Cost of food products, and urban and rural wages in Brazil: 1966-1977

This appendix addresses two problems, the first of which is the measurement of the true behaviour of food costs in Rio de Janeiro and in São Paulo during the 1970's, in comparison with the

[22] Described in *Dietas de Custo Mínimo*, Fundação Getulio Vargas (Rio de Janeiro, 1978). For additional details, see Appendix 2.

distorted picture presented by the "official" price indices of these two cities; second, national wage indices are calculated for the period, both for the urban and rural sectors, to check the evolution of the process of unification of unskilled workers' wages in the country.

A.2.1 — Cost of food products

The food cost indices in the cities of Rio de Janeiro and São Paulo were derived from the retail prices of the food items collected monthly by the IBGE in these and in other state capitals since 1967. The monthly price of each item is estimated by the IBGE based on approximately 15 price observations in each city. Below we only consider the annual averages of these monthly prices.

The weights of each item were estimated based on a recent study of the FGV on minimum cost diets.[23] The diet selected (denominated by the letter H in the FGV study) includes 26 food items which satisfy not only certain minimum nutritional requirements, but also 29 restrictions associated with the habits and preferences of Brazilian consumers. These restrictions are of three types: a) fixed quantities for specific products; b) a maximum ceilling on the share of certain kinds of foods which are nutritionally rich, but poor in flavour; and c) minimum quantities of specific products which are included in the usual Brazilian diet.

Due to statistical considerations, we made the following alterations in diet H of the FGV, so that it could be used together with the IBGE food price survey, to calculate the food cost indices:

a) Vinegar, pepper and collard greens were eliminated from the diet, since their prices were not sought by the IBGE; these omissions do not substantively alter the results, since these foods make up only 4% of the original diet;

b) For lack of information, in the original diet liver was replaced by an equivalent quantity in proteins of second quality beef; we also assumed that the price of filet mignon kept pace with that of prime beef, and that the price of fresh sardines behaved like that of fresh fish; and

c) finally, the weighting of coffee in the diet was reduced from 8 to 3%, since the substantial increases in the price of this comodity during the 70's was causing abnormal increases in the food price index; 3% is the weighting of coffee in the value of domestic food consumption in the new FGV cost of living index for Rio de Janeiro.

[23] Fundação Getulio Vargas, *Dietas de Custo ..., op. cit.*

Table 7

Composition of the FGV's Diet H and of the Modified Diet

Products	Weights in FGV's Diet H	Weights in the Modified Diet
Japanese Rice	0.13267	0.14748
French Bread	0.06459	0.07180
Wheat Flour	0.01448	0.01609
White Potatoes	0.01929	0.02139
Manioc Flour	0.04642	0.05160
Non-refined Sugar	0.03122	0.03470
Black Beans	0.04128	0.04588
Kidney Beans	0.02919	0.03244
Collard Greens	0.02881	
Onions	0.01303	0.01448
Tomatoes	0.01812	0.02012
Oranges	0.01379	0.01531
Filet Mignon	0.06808	
Prime Beef		0.07567
Liver	0.03983	
Second Quality Beef		0.03129
Chicken	0.07925	0.08809
"Carne Seca"	0.03557	0.03954
Eggs	0.03200	0.03556
Fresh Sardines	0.01303	
Fresh Fish		0.01448
Soybean Oil	0.06308	0.07012
Coffee	0.07786	0.02930
Garlic	0.01551	0.01723
Pepper	0.00304	
Salt	0.00346	0.00383
Vinegar	0.00545	
Milk	0.09551	0.10616
Margarine	0.01546	0.01719

SOURCES: FGV, *Dietas de Custo...*, *op. cit.*; and text.

Table 8

Brazil: Alternative Cost of Food Products Indices for 1967/1977

(1970 = 100)

Years	Rio de Janeiro		São Paulo	
	FGV	Diet	FIPE	Diet
1967	57.3	75.4	56.4	57.1
1968	64.6	67.2	68.4	69.1
1969	79.7	81.6	85.3	83.8
1970	100.0	100.0	100.0	100.0
1971	122.0	128.0	124.0	128.0
1972	144.0	158.0	148.0	158.0
1973	165.0	207.0	178.0	213.0
1974	225.0	276.0	228.0	285.0
1975	283.0	363.0	295.0	377.0
1976	403.0	524.0	396.0	527.0
1977	587.0	715.0	551.0	699.0

SOURCES: *Conjuntura Econômica*; and text.

Table 9

Brazil: Averages (μ) *and Coefficients of Variation* (σ/μ) *for Hourly Wages in the Construction Industry (1969/1977)*

(In Current Cr$)

Years	Hod-Carriers		Bricklayers		Construction Foremen	
	μ	σ/μ	μ	σ/μ	μ	σ/μ
1969	0.56	0.041	1.02	0.044	2.02	0.050
1970	0.67	0.035	1.21	0.044	2.41	0.051
1971	0.81	0.030	1.47	0.044	2.78	0.058
1972	0.97	0.029	1.72	0.040	3.46	0.052
1973	1.15	0.029	2.13	0.039	4.39	0.053
1974	1.55	0.042	2.98	0.041	6.38	0.055
1975	2.16	0.043	3.99	0.042	9.06	0.053
1976	3.06	0.041	5.28	0.045	13.41	0.055
1977	4.45	0.041	7.88	0.035	19.26	0.053

SOURCES: IBGE, *Anuário Estatístico* and *Indústria de Construção*.

Table 7 shows the composition of the diet H of the FGV and of the modified diet which we used to calculate the food price idex.

Table 8 compares the trend of alternative indices of food costs in the period 1967-1977. For Rio de Janeiro, we compared the behavior of the FGV index with that of the modified diet. For São Paulo, the comparison was made between the modified diet and the food price index of the Fundação Instituto de Pesquisas Econômicas da Universidade de São Paulo (FIPE).

Until 1970, the differences are minimal between the annual variations of the modified diet and those of the "official" indices.

The same is true for the period 1974-1977 taken as a whole, although the differences in the annual price variations are significant. Nevertheless, in the period 1970-1973, the discrepancies are quite sharp. The differences in the proportional variations of the indices between 1972 and 1973 are especially large. Increases of 30 and 34.8% were recorded in the indices of the diet in Rio de Janeiro and São Paulo, respectively, in comparison with increase of only 14.6 and 20.3% in the "official" indices for these cities.

These results tend to confirm the general consensus in Brazil that the price indices in Rio de Janeiro and São Paulo were manipulated during the early 70's in order to keep the recorded rates of inflation low.[24] In addition, they indicate that it is appropriate to use food prices from this study as deflators to calculate the real value of the wages of unskilled workers in Brazil during the past decade.

A.2.2 — Urban wages

Urban wages were estimated based on the data of the IBGE survey for the construction industry in 20 Brazilian states. The monthly series cover the years 1969 to 1977. Here only the annual averages of the wage are presented.

The wages of three groups of workers in civil construction were considered: hod carriers, bricklayers and construction foremen. In order to obtain national wage indices, the wages for these categories in each state were weighted by the state's share of the total number of employees in civil construction in the country.

The weights were taken from the study by Dorothea Werneck,[25] and the average monetary wages for the country as a whole are shown in Table 9, which also shows the coefficient of variation

[24] On this topic, see the collection of studies published by the *Instituto de Economistas do Rio de Janeiro, op. cit.*

[25] Dorothea F. F. Werneck, *Emprego e Salários na Indústria de Construção, Coleção Relatórios de Pesquisa* (Rio de Janeiro: IPEA/INPES, 1978), no. 40.

(ratio between the average and the standard deviation) of the state averages. These coefficients are invariably small and do not exhibit any discernible tendency.

Table 10 shows the trend of deflated wages, of product-wage and of the real wages of hod carriers, bricklayers and construction foremen for the period 1967-1977.

The deflated wages are the monetary wages divided by the price deflator of the GDP and measure the purchasing power of the wages for goods in general, in the proportion in which the latter are part of the Brazilian GDP. The product-wages are the quotients between monetary wages and the cost of construction in Rio de Janeiro (a proxy of the prices of houses and other recently constructed buildings).[26] They constitute a measure of the purchasing power of wage earners in relation to the product which they help to produce. The real wages are the ratio between monetary wages and food prices (from the previous section) and indicate how much of the basic food diet the wages allow the workers to acquire. The various deflators are shown in Table 11.

Graphs 6 and 7 summarize the empirical results. The first shows the trend of the three definitions of wages with constant purchasing power for the category of hod carriers in civil construction. The second compares the behavior of the ratio between the wages of bricklayers and construction foremen with the wages of the hod carriers.

Both in terms of the price of the product as well as in terms of the price deflator of the GDP, the wages of hod carriers increased significantly during the 1970's. For example, the deflated wage is 15% greater in 1977 than in 1969. However, when measured in relation to food costs, the wage gains disappear. There was a considerable drop in real wages from 1969 to 1973, followed by a recovery which lasted until 1977. At the end of the period, the real wage was 8% lower than in 1969. The contrasting behavior of the various definitions of wages is explained by the sharp increase in the relative prices of agricultural commodities since 1968.

Graph 7 shows that the wages of bricklayers had the same behavior as the wages of hod carriers, and that construction foremen

[26] The index of construction costs for Rio de Janeiro, calculated by the Fundação Getulio Vargas, also underestimated real costs. Therefore, it was replaced in practice by a new "national civil construction price index", with the objective of readjusting Government contracts with the construction industry. Unfortunately, this index is only available since 1974.

Table 10

Wage Indices of Constant Purchasing Power in the Brazilian Construction Industry: 1969/1977

Years	Hod-Carriers			Bricklayers			Construction Foremen		
	Deflated Wage[a]	Product-Wage[b]	Real Wage[c]	Deflated Wage[a]	Product-Wage[b]	Real Wage[c]	Deflated Wage[a]	Product-Wage[b]	Real Wage[c]
1969	97.8	96.5	101	100	99.2	104	99.2	97.9	103
1970	100	100	100	100	100	100	100	100	100
1971	103	105	94.5	103	105	94.5	98.0	100	89.8
1972	105	107	99.1	103	105	89.9	105	107	91.1
1973	104	107	83.3	106	109	85.0	110	113	87.9
1974	105	111	83.3	113	110	89.5	121	127	95.7
1975	111	123	88.4	114	127	90.9	130	145	104
1976	111	121	86.8	106	116	83.6	133	145	104
1977	112	117	92.6	110	116	91.3	135	141	112

SOURCES: IBGE, *Indústria da Construção*; and FGV, *Conjuntura Econômica*.

[a] Monetary wage/implicit deflator of the GDP.

[b] Monetary wage/construction cost in Rio de Janeiro.

[c] Monetary wage/cost of food products in Rio de Janeiro.

Table 11

Brazil: Alternative Price Deflators for 1966/1977

Years	Price Deflator of the GDP	Prices Received by Growers[a]	Cost of Food Products in Rio de Janeiro[b]	Construction Cost in Rio de Janeiro
1966	42.7	44.2	46.8	39.0
1967	55.0	52.7	57.4	55.1
1968	70.3	61.9	67.2	72.7
1969	84.6	77.9	81.6	85.7
1970	100.0	100.0	100.0	100.0
1971	117.0	127.0	128.0	115.0
1972	138.0	158.0	158.0	135.0
1973	166.0	221.0	207.0	161.0
1974	218.0	314.0	276.0	208.0
1975	290.0	391.0	363.0	260.0
1976	411.0	588.0	524.0	376.0
1977	592.0	879.0[c]	715.0	567.0

SOURCES: FGV, *Conjuntura Econômica*; and text.

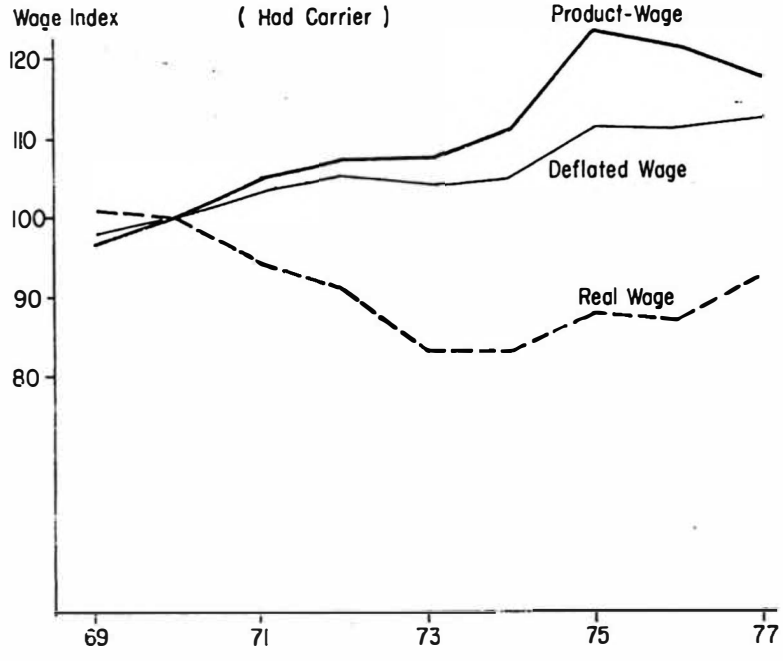
[a] Column 274 of *Conjuntura Econômica*.

[b] FGV food price index for Rio de Janeiro.

[c] Column 17 of *Conjuntura Econômica* (we avoided using column 274 for this year due to a variation of weights, which enormously affects the index).

Graph 6

BRAZIL: WAGE TRENDS FOR HOD CARRIERS IN THE CONSTRUCTION INDUSTRY - 1969/1977 (1970 = 100)



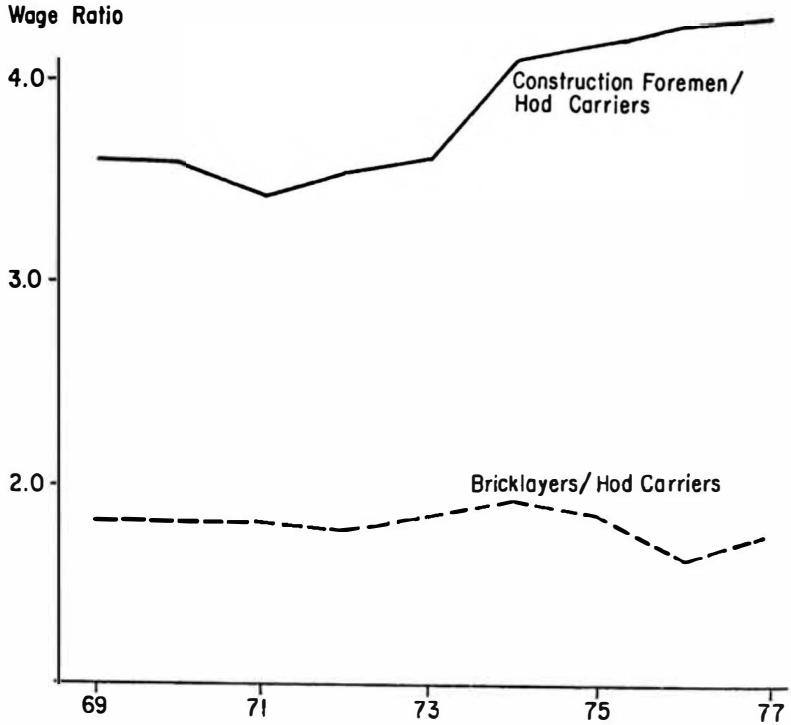
obtained larger wage readjustments during the period. In 1977, the earnings of construction foremen were 4.3 times that of hod carriers as compared to 3.6 times larger in 1976.

A.2.3 — Rural wages

Since 1966, the Fundação Getulio Vargas has been conducting a bi-annual, survey of rural prices and wages. This survey initially encompassed 16 states and presently includes nearly every state in the country: In this article, we considered the information on the wages of day laborers, regularly-employed laborers, tractor operators and farm managers, with reference to 16 states. The information is taken from June of each year for the period 1966-1977, excluding the State of São Paulo and the Northern states. (At the time this

Graph 7

BRAZIL: WAGE RATIOS IN THE CONSTRUCTION INDUSTRY (1969-1977)



survey was being conducted, information on wages in São Paulo were available in the *Instituto de Economia Agricola,* but not in a form which could immediately be integrated with information from the FGV).

The weights for employment for the rural wage indices were taken from *Conjuntura Econômica,* 1971. Table 12 presents information on averages and the coefficients of variation of nominal wages of the four groups of workers from 1966 to 1977. At least in the case of the day laborers, there appears to have been a tendency towards a decreasing wage dispersion among the State of the Fede-

Table 12

Brazil, 16 States: Rural Wages, Averages, and Coefficients of Variaton for 1966-1977 (in June of Each Year)

Years	Day Laborers (Cr$/day)		Permanent Laborers (Cr$/month)		Tractor Operators (Cr$/month)		Farm Managers (Cr$/month)	
	μ	σ/μ	μ	σ/μ	μ	σ/μ	μ	σ/μ
1966	1.53	0.092	46.0	0.041	85.2	0.041	83.2	0.118
1967	2.03	0.056	61.8	0.040	105.0	0.034	109.0	0.102
1968	2.51	0.054	73.6	0.043	132.0	0.043	123.0	0.085
1969	2.95	0.050	84.8	0.046	152.0	0.026	146.0	0.074
1970	3.44	0.061	98.9	0.045	177.0	0.022	186.0	0.060
1971	4.44	0.062	129.0	0.053	226.0	0.023	225.0	0.070
1972	5.36	0.061	155.0	0.055	281.0	0.019	272.0	0.072
1973	6.93	0.050	201.0	0.055	346.0	0.021	345.0	0.076
1974	12.0	0.040	303.0	0.041	478.0	0.028	529.0	0.078
1975	16.8	0.049	406.0	0.044	687.0	0.027	829.0	0.094
1976	22.7	0.049	551.0	0.045	909.0	0.033	1 084.0	0.086
1977	32.9	0.042	816.0	0.046	1 398.0	0.026	1 544.0	0.077

SOURCE: FGV, *Conjuntura Econômica*.

ration. Table 13 shows the trend of deflated wages, product-wages and real wages for each group of workers.[27] The concepts are similar to those of the previous section, with the exception of product-wage, which is the quotient between monetary wage and the index of prices received by the growers.

The wage trends of day laborers and regularly employed laborers are shown on Graphs 8 and 9. Graph 10 compres the earnings trend of the various groups of workers with the wages of rural day laborers.

[27] It should be noted that nominal wages refer to June of each year, whereas the price indices are annual averages.

Table 13

Brazil, 16 States: Rural Wage Indices of Constant Purchasing Power for 1966-1977

Years	Day Laborers			Permanet Laborers			Tractor Operators			Farm Managers		
	Deflated Wages[a]	Product-Wage[b]	Real Wage[c]	Deflated Wages[a]	Product Wage[b]	Real Wage[c]	Deflated Wages[a]	Product-Wage[b]	Real Wage[c]	Deflated Wages[a]	Product-Wage[b]	Real Wage[c]
1966	104	101	95.2	109	105	100	113	109	103	105	101	95.5
1967	107	112	103	114	119	109	108	113	104	106	111	102
1968	104	118	109	106	120	111	196	120	111	93.6	107	98.2
1969	102	110	105	101	110	105	102	111	106	92.8	101	96.2
1970	100	100	100	100	100	100	100	100	100	100	100	100
1971	110	102	101	112	103	102	109	101	128	103	95.3	94.5
1972	113	98.7	99.7	114	99.4	99.4	115	101	101	106	92.4	92.4
1973	122	91.4	97.6	122	91.9	98.1	118	88.2	94.2	112	83.7	89.4
1974	160	111	126	140	97.5	111	124	86.0	97.8	130	90.4	103
1975	160	125	135	142	105	113	134	99.2	107	164	113	123
1976	161	112	126	136	94.7	106	125	87.2	97.9	142	99.0	111
1977	161	109	134	139	94.0	116	133	89.8	110	140	88.2	108

SOURCE: FGV, *Conjuntura Econômica.*

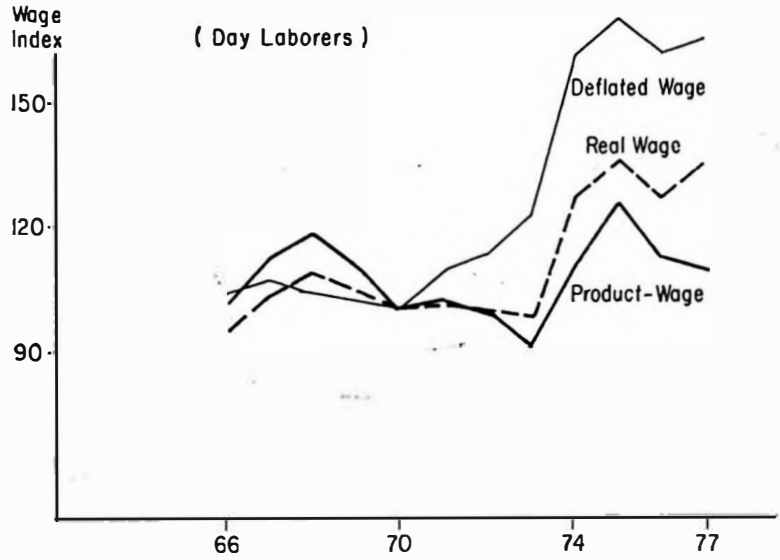
[a] Monetary wage/implicit deflater of the GDP.

[b] Monetary wage/price received by the growers.

[c] Monetary wage/cost of food products in Rio de Janeiro.

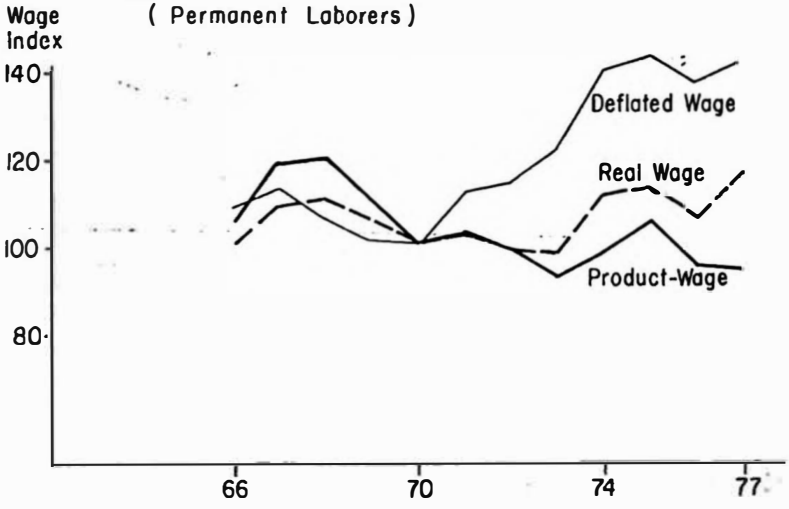
Graph 8

BRAZIL: WAGE TRENDS OF RURAL DAY LABORERS - 1966-1977 (1970=100)



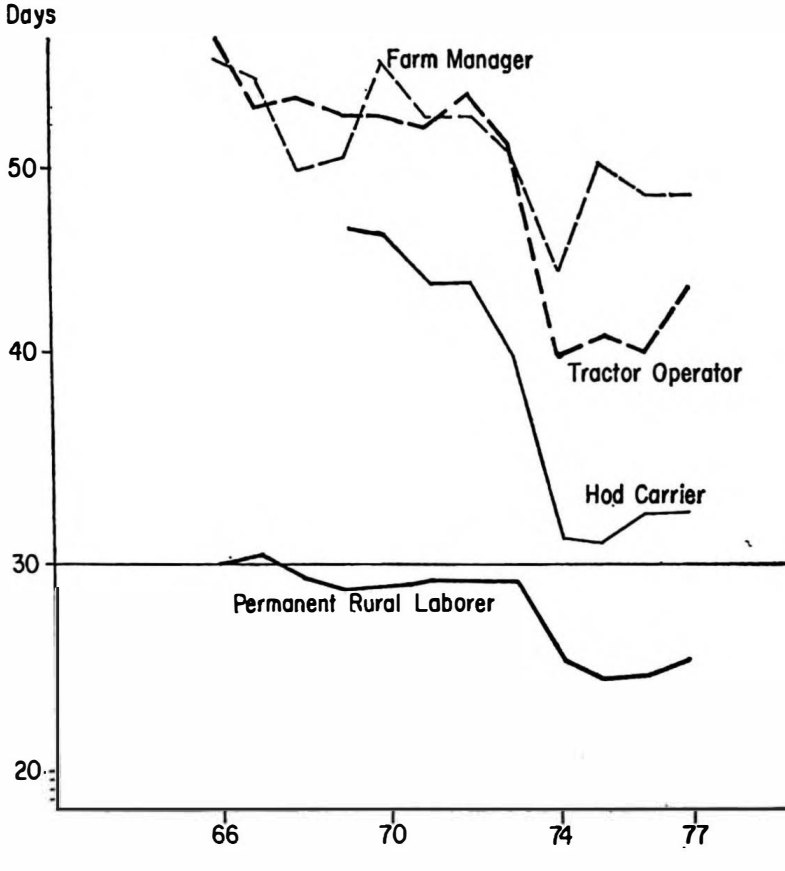
Graph 9

BRAZIL: WAGE TRENDS OF PERMANENT RURAL LABORERS – 1966-1977 (1970 = 100)



Graph 10

NUMBER OF DAYS THAT A RURAL DAY LABORER NEEDS TO WORKER IN ORDER TO ATTAIN THE MONTHLY WAGE LEVELS OF OTHER GROUPS OF LABORERS (1966-1977)



The Brazilian manufacturing industry: structure and trends of profits and wages, 1959-1974 *

Claudio M. Considera **

1 — Introduction

The majority of studies on income distribution in Brazil deal with personal, rather than functional, distribution. Thus, the profit-wage dichotomy, as well as the distribution of profits and wages among the various economic agents, is rarely studied. [1] The most general objective of this paper is to contribute to the existing knowledge on these two aspects of functional distribution as they relate to the manufacturing industry.

Studies on the personal distribution of income, using the most diverse types of income statistics, indicate a sharp increase in the

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* The credit for this article is due in large part to the tireless assistance and encouragement of Paulo Vieira da Cunha, since the author was not entirely familiarized with the vast literature on the labor market. The criticism and suggestions of Martim Smolka, Milton da Mata, Regis Bonelli, Celsius Lodder and Anna Luiza Ozorio de Almeida, colleagues from INPES, and of Edmar Bacha, contributed substantially to improve the preliminary draft of this study. The statistical data were patiently processed by Economics students Luiz Carlos Pereira de Souza and Luiz Octávio Parente de Mello. Originally published in *Pesquisa e Planejamento Econômico*, vol. 10, n.º 2, April 1980.

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1 As exceptions we can cite the pioneering work in this area of Edmar L. Bacha, "Hierarquia e Remuneração Gerencial", in R. Tolipan and A. C. Tinelli (eds.), *A Controvérsia sobre Distribuição de Renda e Desenvolvimento* (Rio de Janeiro: Zahar, 1975), Milton da Mata and Edmar L. Bacha, "Emprego e Salários na Indústria de Transformação, 1949/69", in *Pesquisa e Planejamento Econômico*, vol. 3, no. 2 (June, 1973), pp. 303-340, and Rodolfo Hoffmann, "Considerações sobre a Evolução Recente da Distribuição de Renda no Brasil" (Piracicaba: USP/ESALQ, 1973) mimeo.

concentration of income occurring during the post-1960 period. [2] Three reasons (or any combination of them) may have contributed to this prenomenon: a) an increase in the concentration of assets and, consequently, a greater concentration of profits; b) given any distribution of assets, some event which would have caused an increase in the profit share; and c) given a functional distribution, some event having caused the wage increases for some, to the detriment of the majority.

Aside from the distribution of assets (which remains as unknown in Brazil), we can generally identify two opposing interpretations of the causes of the increase in concentration. On the one hand, some believe that an increase in the share of profits took place, along with a rise in the wages of a small percentage of workers, by virtue of the economic policy implemented during the last 15 years, namely, the sharp increase in the value of capital, through subsidies and wage control in the case of the less skilled laborers. [3] On the other hand, there are those who attribute the increased concentration to the market forces, by stating that during a period of rapid growth, some of the more highly skilled labor categories were overvalued, due to their scarcity. However, this group makes no mention of functional distribution. [4]

As was to be expected, one of the major points of this wide ranging controversy on income distribution is wage policy. Its critics, armed with statistics on minimum wages and on the analysis of the wage readjustment formula and the parameters used therein (i.e. predicted and real inflation), have attempted to demonstrate that the past 15 years have been characterized by a decline in real wages of the large majority of laborers. Its defenders take the opposite position, based on statistics on average wages. [5]

[2] For example, making use of the study conducted by IPEA (IPLAN/CNRH), "Indicadores Sociais para Uso do CDS (Base Anual): Resumo da Situação 1960-1978" (Brasília: IPEA, May, 1979), mimeo, note that the Gini coefficient of income distribution of the economically active population was 0.60 in 1960, 0.62 in 1970, 0.63 in 1976 (data from the *Censo Demográfico do Brasil* (1960 and 1970) and from the *Pesquisa Nacional por Amostra de Domicílios* (National Survey of Household Samples) (1972 and 1976).

[3] The articles of the collection published by R. Tolipan and A. C. Tinelli, *op. cit.*, are representative of this interpretation.

[4] Its best known representative is the study C. G. Langoni, *Distribuição de Renda e Desenvolvimento Econômico do Brasil* (Rio de Janeiro: Expressão e Cultura, 1973).

[5] For a retrospective of recent studies on industrial wage trends, see Paulo Renato Souza and Paulo Eduardo Baltar, "Salário Mínimo e Taxa de Salários no Brasil", in *Pesquisa e Planejamento Econômico*, vol. 9, no. 3 (December, 1979), pp. 629-660. In this paper, the authors criticize this type of result and attempt to characterize the growing dispersion in industrial wages since the early 1960's. In terms of wages, this dispersion favored a small share of the industrial workers, to the detriment of the large majority, whose wages followed the

It appers that the only point of consensus in the entire debate is that there was an increase in the concentration of income during the last 15 years. The origins of this increase and the reasons for which it took place, are still a source of controversy, and will probably remain so, given its strong political implications. In this paper, we shall attempt to prove that the origins of the greater concentration of income are the increase in the profit share and the favored position of certain wage categories. These phenomena are, in turn, caused by both the economic policy which increased the value of capital, and the subsequent wage squeeze of the post-1964 period.

This study is divided into two sections, the first of which comprises an analysis of the structure and trends of the distribution of income between profits and wages, by branch of the manufacturing industry, for the period 1959 to 1974. It has been demonstrated that, during the period in question, there was a sharp increase in profits' share of income in all branches of the manufacturing industry. Given the lack of data on capital subsidies, this result is apparently due only to the wage containment policy then in effect.

In the second section of this study, we analyze the structure and trends of the distribution of wages by branch of the manufacturing industry for the period 1970 to 1974, by distinguishing two categories: high and low wages. The results indicate that the structure and performance of the industrial categories explain the major part of the wage differences between categories. In addition, it is shown that the data on structure and performance also explain the differences in the average wages of those categories by branch of the industry.

2 — Structure and trends in the share of profits by branch of the manufacturing industry: 1959, 1970 and 1974 [6]

The objective of this part of our study is to examine the behavior of the profit share of income in [7] the manufacturing industry between

same trend as the minimum wage and which, like the minimum wage, sharply declined in real value. They also conclude, in support of the thesis attributed to Francisco de Oliveira, "Economia Brasileira: Crítica à Razão Dualista", in *Seleções CEBRAP* (São Paulo: CEBRAP, 1976), that the minimum wage acted, in effect, as the economy's wage rate in the period which began in the 1960's. Note that this thesis had already been defended by Milton da Mata and Edmar Bacha, *op. cit.*, and Edmar Bacha, *op. cit.*

[6] The statistics used in this section were taken from *Censos Industriais*, for 1960 and 1970 and *Pesquisa Industrial*, 1974.

[7] Defined here as the profit share (gross of income tax) in the total income generated (profits + total wages). Profits were calculated by deducting total

1959 and 1974. We shall also attempt to relate this trend to several current hypothesis in Brazilian economic literature.

2.1 — Determinants of the profit share

According to Kalecki, given the dominant characteristics of the commodity markets and of the means of production (monopolies, oligopolies, unions), the relative profit share in the value-added of the industry is determined by two factors (aside from the sectorial composition of the value-added): a) the degree of monopoly; and b) the ratio of the prices of raw materials to the unit cost of labor or, more simply put, the total cost of raw materials to total wages. [8] An increase in the degree of monopoly or the prices of raw materials in relation to the unit cost of labor would result in an increase in the share of profits. During the business cycle, the opposite effects of those determinants would be compensated and, therefore, the profit share would not undergo sharp fluctuations as a result of the cycle.

Within this formulation, besides the firms' increased market power and the increase in the relative share of capital to labor, [9] another factor which could increase the profit share would be a reduction in real wages through, for example, a government policy of wage containment, implemented through strict control of unions. During periods of rapid economic growth, however, increases in real wages

wages and miscellaneous expenditures from the *valor da transformação industrial*. •

• Translators' note: The term *valor da transformação (industrial)* will not be translated here, as there is no English equivalent. According to Regis Bonelli, in *Tecnologia e Crescimento Industrial: a Experiência Brasileira nos Anos 60* (Série Monográfica, Rio de Janeiro: IPEA/INPES, 1976), "There are no estimates available to calculate this variable... Neither the Brazilian Industrial Censuses nor the National Accounts present estimates of the value-added at the aggregate level used in this study. One of the variables comparable in both the Censuses of 1960 and 1970 is the Net Value of Production (NVP), measured by factor cost. Deducting expenditures on Raw Materials, Fuel and Lubricants, Electric Energy, Packaging; and the cost of contracted intermediary services gives us another magnitude which is comparable in both cases: the *valor da transformação industrial* (VTI). The difference between the VTI and the value-added is a numerous group of expenditures (Diverse Expenditures-DE)".

[8] Michael Kalecki, "Distribution of National Income", in *Selected Essays on the Dynamics of the Capitalist Economy* (Cambridge: Cambridge University Press, 1971), pp. 62-77. For an application of this analytical reference to Brazil, see Raul Eckerman, "Parcela Salarial e Tamanho da Firma", in *Pesquisa e Planejamento Econômico*, vol. 8, no. 1 (April, 1978), pp. 231-240. The value-added is the total of profits + wages of the workers + fixed costs, the latter including the wages of administrative personnel.

[9] To put the organic composition of capital of Kalecki's proposition in other terms.

may result in a reduction of wages' share of output, since such increases are lower than those in real output *per capita,* or, rather, of productivity. This indicates that increases in productivity benefit capital more than labor, through a rise in profits higher than that of wages.

2.2 — Structure of the profit share, by branches of the manufacturing industry

Based on the aforesaid discussion, one would expect that:

a) the industry branches displaying greatest degrees of monopoly obtain greater profit shares. Using the concentration coefficient as a measure of the degree of monopoly, we note in the data from Table 1 that there is a close association between greater degrees of monopoly and greater profit shares, and that, in 1959, this association was even closer than in 1970. [10]

b) those industrial branches in which the composition of the direct costs of production favor raw materials over wages (or which are more capital-than labor-intensive) produce greater profit shares. The available data reveal that this relation is quite close, whichever measure is used for the organic composition. Curiously, the relation is closer for the year 1959 than in 1970 and more in 1970 than in 1974. This could be the result of the increasing governmental intervention in the restriction of labor union movements, resulting in the extramarket factor discussed above. [11]

2.3 — Trend of profit shares by branches of the manufacturing industry

Note from the figures in Table 1 that, from 1959 to 1970, with the exception of Rubber Goods, all other branches indicate an increase in the profit share. Of the 20 branches, 13 show increases equal or superior to that of the manufacturing industry average, which was 22% during that period, representing an average annual rate of 1.7%.

During the period 1970 to 1974, the share of profits continued to grow, though at a reduced rate. With regard to the industry

[10] The Spearman coefficient of rank order correlation were, respectively, for 1969 and 1970, 0.62 and 0.52, both significant at the 1% level.

[11] The Spearman coefficients for the ratio of total cost of raw materials/total wages and share of profits, were respectively, for 1969, 1970 and 1974, 0.74, 0.63 and 0.56, all significant at the 1% level. For the capital-labor relation and the share of wages, the Spearman coefficients are, for 1969, 1970 and 1974, respectively, 0.81 (1%), 0.50 (2%) and 0.49 (5%).

average, the growth was 2.4% during the period, which represents an average annual rate of 0.5%. There was an increase in the share of profits in thirteen branches, and in seven a decrease was observed, with significant variations (above 9.5%) occurring in only seven categories.

It is interesting to note that the largest increases in the profit share for the period of 1959 to 1970 took place in the industrial branches which obtained a share of profits lower than the average of the manufacturing industry, such that the order of magnitude of the profit share among the industrial categories changed little; [12] these variations only made the distribution of the share of profits less disperse among the categories. [13] In the period 1970 to 1974, the variations which took place in the profits share did not change this picture very much. [14]

It is important, however, to observe that the industrial branches whose profits share increased the most in the period of 1959 to 1970 are recognizedly those which adopted less mechanized production processes. [15] As Table 1 indicates, the industries in which the profits share increased the most in the period 1959 to 1970 were those which had the smallest capital/labor ratio, both in 1959 and in 1970. [16] In addition, they were not the most modernized industries, as we are led to believe by the lack of statistically significant relation between the rise in the share of profits and the increase in capital intensity. [17]

On the other hand, the 1959 and 1970 indices of industrial concentration, although not strictly comparable, show that the variations in the degrees of monopoly in all branches (with the excep-

[12] The value of the Spearman coefficient between the profit shares of 1959 and 1970 was 0.85, significant at the 1% level.

[13] The variation coefficient (standard deviation/mean) between the profit shares in 1959 was 0.21, while in 1970 it is 0.12.

[14] The value of the Spearman coefficient between the magnitudes of the profit shares of the industrial sectors in 1970 and 1974 was 0.71, significant at the 1% level, while the variation coefficient in 1974 is 0.14.

[15] Understood in this context as the utilization of motor-driven machinery and equipment in the productive process, measured in terms of electrical energy consumed in industrial operations, by production personnel.

[16] The Spearman coefficients between the increase in the profit share form 1959 to 1970 and the capital/labor ratios in 1959 and 1970 were, respectively, —0.49 and —0.52, both significant at the 1% level.

[17] The Spearman coefficients between the increase in the profit share and in capital intensity in the period 1959-1970 and 1970-1974 are, respectively, —0.17 and 0.30, both not significant.

tion of Mechanics) were decreasing, although negligibly.[18] Even though, for methodological reasons, the indices of concentration were in fact greater in 1970 than in 1959, the difference was not very significant and certainly insufficient to explain the increases recorded in the share of profits.

Therefore, the only remaining explanation is the wage squeeze, which was applied during that decade.[19] Taking the trends of value-added and employment in the total manufacturing industry during the period 1959 to 1970, it can be observed that they showed an average annual growth of 8.4 and 3.1% respectively, which gives an annual growth rate in productivity of approximately 5.3%.[20] Note, however, that the real average wage in the manufacturing industry rose during the same period at a rate of 3.8% per year.[21]

This set of information sheds considerable light upon the economic occurrences of the period under study; generally speaking, the wage squeeze in effect since the mid-1960's made possible a considerable increase in the manufacturing industry's profit share. In the branches whose production processes are more labor-intensive, the increase in the share of profits was sharper than in those which used more capital-intensive processes. Between 1970 and 1974, the wage policy in effect was mitigated; curtailing the functional redistribution of income in favor of profits, which even so were substantial in several branches.

18 The distribution of establishments by volume produced for the year 1959 includes all establishments, whereas for the year 1970 establishments with less than five employees and/or value of production less than 640 times the highest minimum wage in effect in 1970, are excluded. Thus, the concentration in 1970 is slightly greater than the coefficients indicate. In 1974, the distortions are much greater, although the selection of establishments are identical to that of 1970: a) the number of categories by volume produced is much smaller than in 1959 and 1970; and b) the values in cruzeiros of the classes are the same as 1970. The combination of these two characteristics results in an accumulation of value of production in the last class, marking the Lorenz curve subject to a cut, reducing the Gini coefficient.

19 In this regard, see, for example, Lívio W. R. de Carvalho, "Princípios e Aplicação da Política Salarial Pós-1964" (Brasília: University of Brasília, Department of Economics, 1973), *Textos para Discussão* no. 9, mimeo.

20 Data from Regis Bonelli, *Tecnologia e Crescimento Industrial: A Experiência Brasileira nos Anos 60*, Série Monográfica (Rio de Janeiro: IPEA/INPES, 1976), no. 25. Tables I.2 and A.I.1, pp. 73 and 186, respectively.

21 Data from *Censos Industriais*, 1960 and 1970. The average wage was obtained by dividing total wages by the monthly average of employed individuals. In order to determine the real average wage, we utilized the implicit deflator of the value-added in the manufacturing industry (40.5), calculated by Regis Bonelli, *op. cit.* This is equivalent to interpreting wages as a component of industrial costs. If the deflator is considered to be the cost of living in Rio de Janeiro (44.3), in search of some measure of welfare, an increase of real average wages of only 3.1% per year is found.

Table 1

Profit Share, Capital/Labor Ratio, Raw Materials/Wages Ratio, and Concentration Coefficients by Branches of the Manufacturing Industry: 1959, 1970 and 1974

Industrial Sectors	Share of Profits %			$\left(\frac{\text{Profits}}{\text{Profits + Wages}}\right)^a$			Capital/labor Ratio (1.000 KWH/ production employee)b			Raw Materials/Wages Ratio				Correlation of Coefficients (Gini)	
	Total Establishment			Establishments of five or more people employed and/ or value of production more than 640 times the highest minimum wage in effect in year of the survey						Total Establishments		Establishments of five or more employees and/ or value of production 640 times the highest minimum wage in effect during year of survey			
	1959	1970	Variation 1959-70	1970	1974	Variation 1970-74	1959	1970	1974	1959	1970	1970	1974	1959	1970
Non-Metallic Minerals	54,0	68,0	+25,9	67,8	69,5	+ 2,5	4.998	9.209	15,162	1,77	2,31	2,32	2,85	0,886	0,882
Metallurgy	56,1	69,4	+23,7	69,4	74,1	+ 6,7	11.661	21.512	28,280	3,47	5,80	5,81	7,37	0,894	0,874
Mechanics and Electrical and Communications Equipment	46,8	60,7	+29,7	60,6	59,8	— 1,3	2,305	3,345	4,020	2,16	2,33	2,33	3,04	0,828	0,812
Mechanics	40,5	56,2	+38,8	56,0	55,1	— 1,6	1,696	3,290	3.790	4,06	3,56	3,56	4,76	0,792	0,800
Electrical and Communications Equipment	52,3	66,5	+27,1	66,5	67,0	+ 0,7	2.975	3,430	4,440	3,06	2,78	2,79	3,40	0,835	0,812
Transportation Equipment	54,9	65,0	+18,4	65,0	69,4	+ 6,7	2,775	5,546	5,180	4,00	4,52	4,52	8,87	0,931	0,918
Wood	58,8	68,6	+18,2	62,9	78,6	+17,0	1,527	2,698	3,728	2,73	3,72	3,73	4,82	0,736	0,665
Furniture	39,0	58,1	+48,9	57,4	57,5	+ 0,1	1,212	1,081	1,720	2,22	2,80	2,75	3,42	0,789	0,709
Paper and Cardboard	81,6	63,8	+ 3,8	63,8	78,4	+22,9	18.413	22.787	30.243	5,29	4,22	4,22	7,39	0,828	0,790

Rubber	78,9	78,3	— 0,7	78,4	73,2	— 6,6	8,253	9,157	10,570	6,85	5,11	5,11	5,85	0,899	0,878
Leather, Hides and Similar Products	52,8	64,4	+21,9	64,0	62,3	— 2,6	2,238	3,016	3,610	4,08	4,80	4,79	5,78	0,868	0,747
Chemicals, Pharmaceuticals Cosmetics, Soaps and Candles	69,4	81,6	+17,6	81,6	82,1	+ 0,6	13,303	24,705	39,390	6,69	8,55	8,56	18,30	0,878	0,836
Chemicals	73,8	85,1	+15,3	80,2	84,6	+ 5,5	17,193	33,124	54,340	4,38	4,30	4,36	3,82	0,876	0,838
Pharmaceutical and Veterinary Products, Cosmetics, Soaps and Candles	55,2	84,3	+52,7	84,5	74,0	—12,4	3,884	4,827	6,390	5,90	7,36	7,37	13,36	0,836	0,800
Plastics	63,2	74,9	+18,5	75,0	75,6	— 0,8	3,865	5,611	7,810	3,37	4,66	4,67	4,99	0,819	0,789
Textiles	45,2	64,0	+41,6	64,0	70,1	+ 9,5	3,427	5,165	7,830	3,68	4,44	4,44	7,42	0,800	0,755
Clothing, Footwear and Cloth Goods	44,6	61,9	+38,8	61,8	62,8	+ 1,6	0,695	0,798	1,050	3,31	4,34	4,31	4,82	0,764	0,715
Food Products	67,3	78,6	+16,8	78,5	76,1	— 0,3	5,471	7,586	8,570	9,53	14,27	14,50	15,36	0,834	0,816
Beverages	58,7	68,6	+16,8	68,4	75,3	+11,5	3,650	5,613	11,520	3,29	3,48	3,44	3,49	0,901	0,853
Tobacco	79,5	86,0	+ 8,1	86,1	89,1	+ 3,4	0,968	2,012	2,540	5,60	4,81	4,81	7,02	0,897	0,825
Publishing and Printing	38,9	56,1	+44,2	56,0	64,7	+15,5	1,518	1,651	2,510	1,83	1,54	1,54	1,94	0,818	0,804
Miscellaneous	43,9	65,8	+49,8	65,9	51,1	—22,4	1,469	5,280	12,810	1,80	2,52	2,51	2,09	0,815	0,750
Manufacturing Industry — Total	57,2	69,8	+22,0	69,7	71,4	+ 2,4	5,135	8,256	11,410	4,51	5,06	5,14	5,89	0,898	0,851

SOURCE: Original data from the *Censos Industriais* of 1960 and 1870, and from *Pesquisa Industrial* (Industrial Research), 1974**

OBS: The results from several industries were aggregated for the purpose of making them comparable with the results of wages of the Law of the 2/3. The data on the relation of capital to labor are comparable only between 1970 and 1974 (smaller establishments not included).

a Profits do not exclude income tax: they were calculated by subtracting total wages and miscellaneous expenditures from the value of the transformation.

b Electrical energy consumed in industrial operations (1.000 KWH) per production employee.

c The coefficients of concentration are not perfectly comparable between the years; that of 1970 does not include smaller establishments (details in text, note 18).

d Establishment, translated from the Portuguese *estabelecimento*: "It is the basic unit of statistical information. Units of Production, Production Support Units, and Industrial Service Units are considered as "lines of production." The Production Unit is the place where a single commodity or related commodities are produced, using the same raw materials or the same industrial processes. Each Unit of Production usually comprises a Physical or Local Unit (factory, plant, mine, etc.) When there existtwo or more Units of Production within a Single Physical or Local Unit, utilizing different raw materials or production processes (as occurs in the metals and automobile industries, among others), each Unit of Production is researched separately, as a specific "line of production" to the extent that operational conditions permit." *Censo Industrial*, IBGE, Rio de Janeiro, 1979, p. XVIII.

** Census based on a sample only encompassing "establishments" with five or more employees.

3 — Structure and wage trends, by wage groups and branches of manufacturing industry for the period 1970/74

In this section of our study, we shall first analyze the distribution of wages and the composition of the labor force which generates these wages, by branches of the manufacturing industry. For the purpose of analyzing the distribution structure, we must relate it to the elements of industrial structure and performance. Once the wage structure is classified, we then proceed to examine how the wage distribution changed over the course of the period 1970 to 1974. Preceding the two empirical sections of this paper, a theoretical discussion is elaborated, to serve as a basis for analysis.

3.1 — Determinants of labor market segmentation and of the structure and trends of industrial wages

3.1.1 — Rejection of the theory of human capital

Traditional literature on the determinants of labor market segmentation and the structure and trends of industrial wages is vast and controversial. Two sets of determining factors of those characteristics of the labor market can usually be identified in the body of theoretical knowledge: the first refers to the conditions of the labor force itself (both supply and demand), and the second concerns each industry's particular structural conditions.

For those economists who emphasize the first group of factors, wages are determined by the confrontation between the employer's requirements and the characteristics of the labor supply (formal and informal qualification, sex, age, race, preferences of the laborer, etc.). Wages set in this manner make possible the maximization of utility of the laborer as well as the firm's profits. For the opponents to this theory, the determinants of the wage structure are basically derived from inter-industrial relations, such as market power, productivity and profitability.

Recent efforts have been made to synthesize these two theoretical currents although without the approval of specialists in inter-industrial relations: it was believed that the two explanations are either complementary or that the empirical corroboration of the defenders of inter-industrial relations can be reinterpreted as favorable to the defenders of the competitive system. [22]

22 See, for example, Melvin W. Reder, "Wage Differentials: Theory and Measurement", in J. F. Burton Jr. *et alii*, *Readings in Labor Market Analysis* (Chicago: Holt, Rinehart & Winston Inc., 1971), pp. 281-309.

Given the difficulties in substantiating such statements and the complexity of this comparative exercise, we shall not endeavor to confront our theoretical basis with the neoclassical formulation. It is necessary, however, to distinguish them on least two points: a) the theoretical arguments developed here take into consideration the specific characteristics of the modern capitalist system of production; and b) the functioning of the labor market should be understood through the social aspects of the capital-labor relation.

In this context, we must clarify that, unlike in neoclassical theory, the relation between the laborer's hierarchical position in a given firm (and, consequently, his relative wage) and his professional qualifications is determined by his current job position, rather than his qualifications. [23] In other words, the supply and demand curves would not be independent, but the latter would determine the former. This would be unacceptable in the postulates of neoclassical economics.

We have rejected the neoclassical argument for precisely this point: it is clear that the relative position of the laborer depends fundamentally on his current position and less on his personal attributes. This argument is reinforced by the fact that personal attributes are the essential criteria for the selection and promotion of personnel, and for the distribution of specific functions. It must be acknowledged that the selection process is also a process of social differentiation, and that the educational system, having developed most of the individual's personal attributes, is merely the front line of the process of differentiation, operating under the command of the production process, and consonant with a specific historical development. [24]

3.1.2 — The internal labor market theory [25]

The internal labor market is defined as "an administrative unit, such as a factory, within which price formation and labor allocation are determined by rules and administrative procedures". [26] It is thus "distinguished from the external labor market of conventional eco-

23 For a critical assessment of the neoclassical theory with emphasis on the formulations of human capital, see Paulo Vieira da Cunha and Regis Bonelli, "Estrutura de Salários Industriais no Brasil: Um Estudo sobre a Distribuição de Salários Médios em 1970", in *Pesquisa e Planejamento Econômico*, vol. 8, no. 1 (April, 1978), pp. 117-168.

24 *Ibid.*, pp. 131-142.

25 Reference used in Peter B. Doeringer and Michael J. Piore, *Internal Labor Markets, and Manpower Analysis* (Lexington, Massachusetts: D.C. Heath, 1971).

26 *Ibid.*, pp. 2-3.

nomic theory, where decisions regarding price formation, allocation and training are determined by economic variables". [27] The two markets are closely interconnected by certain labor categories, which serve as access to ports of entry to the internal labor market. Vacancies are filled in the internal labor market according to its own rules, by utilizing or promoting personnel already employed by the firm. The internal labor market is completely independent of the direct influence of the competitive forces of the external market. [28]

The internal labor market bases its operations on three factors: [29]

a) labor qualifications specific to each firm; differing from general qualifications, which are usually acquired through formal education; b) on-the-job training, obtained informally through contact with the function itself and by observation of the functions of other workers; and c) habits and customs imposed either by management directives or, spontaneously, through the interaction of the stable group of workers.

The advantages of a labor market internalization process are manifold, for both the firm and the employees. Its principal characteristic (labor force stability) eliminates or reduces diverse tangible costs for the firm (i.e., selection and training, etc.) as well as intangible costs (predictible social behavior, confidence, etc.). On the other hand, it provides the existing staff with security in regard to wage levels, promotions, equal treatment, job stability, rewards for seniority. This system also affords some control over possible transformations of the firm which may affect employees, through the unionization facilitated by the internalization of the labor market. [30]

The determination of wages within the internal labor market is radically different from that of the external market, where the forces of the competitive system prevail. Three aspects of the internal wage structure can be identified at the industrial level: a) the wage level of the firm or factory as a point of reference in relation to other firms or industries, not always translated into precise monetary terms in wage negotiations; b) the vertical differentiation of the wage structure, referring to the wage differentials among workers performing different functions, according to the personnel qualifi-

27 *Ibid.*

28 *Ibid.*

29 On the historical character of these phenomena, see Paulo Vieira da Cunha, "A Organização dos Mercados de Trabalho: Três Conceitos Alternativos", in *Revista de Administração de Empresas*, vol. 19, no. 1 (January-March, 1979), pp. 29-46, especially Section 4.2, pp. 38-40.

30 See P. B. Doeringer and M. J. Piore, *op. cit.*, Chap. 4.

cations required for the exercise of the function and according to the characteristics of the function itself; and c) horizontal differentiation, with regard to the wage differentials among workers exercising the same function, according to the merits of each individual workers, while exercising some function within the firm, or according to a system of incentives to productivity. Although this structure could be identified and interpreted as that of neoclassical theory, it is different from that it does not reflect market forces in the short run, but rather emanates from a broad system of managerial control, directed towards assuring long-term responses of the firm to market forces. [31]

As has been mentioned, the segmentation of the labor market is derived not only from the historical process of accumulation/concentration of capital (technical relations of production), but also from the new social capital-labor relations, needed to maintain and increase the domination of capital over the labor process. [32] In terms of the development of the technical relations of production, "... insofar as the firms increased in size, complexity and technological sophistication (and while the concentration of capital molded the market into monopolistic spheres of influence) it became both necessary and profitable for the larger firms to develop their own internal mechanisms to control, distribute and pay labor. This is partially due to the fact that, with the intensification of the division of labor, the production process assumed evermore discontinuous and fragmented forms, composed of a great number of interrelated tasks. Thus, the type of labor in each one of the links would become even more specific, requiring special, if not complex, skills for their execution. Furthermore, the creation of internal markets responded to a technical requirement of the process of occupational training (previously implicit). Given the growing specificity of the training, the development of new work methods became generalized, not in classrooms and through the traditional learning process, but rather in the very process of production". [33]

On the other hand, these technical elements were not sufficient for the establishment of internal labor markets. "The decisive impulse must have been a result of changes in the relations ... of production ... Admittedly, the operation of these markets depended, from the outset, on the technological practices and the specific job qualifications required by each sector. However, even a cursory review would indicate that the most outstanding characteristic of the period during which these new market forms emerged was the

31 *Ibid.*

32 See Paulo Vieira da Cunha, *op. cit.*, Section 4.2, pp. 38-40.

33 *Ibid.*, p. 38.

accelerated introduction of automated production processes. Consequently, production tasks were compartmentalized, thus radically simplified, demanding less specific training and making obsolete a number of previously acquired skills. In short, the tendency towards automation homogenized the work force in that it reduced the number of occupations required in production and, at the same time, the level of skill demanded for each of these. [These transformations] would have emerged from the moment that, for certain fractions of capital, control over the labor process was threatened; more precisely, this control was weakened by workers' resistance movements that came about *despite* the increased domination exerted by the newly introduced machinery system — a system that, in effect, divested the mass of workers of control over their own labor." [34]

3.1.3 — Production structure, internal labor market and wage differentiation

Current literature in the area of industrial economics is profuse in its emphasis on the role of the accumulation/concentration of capital in the emergence of privileged firms and industries. Such firms dispose of oligopolistic (or even monopolistic) market mechanisms which permit the permanent reproduction of incomes (profits and wages) which considerably exceed the income generated by the firms or industries operating in a competitive market. [35] In other words, the greater the firm's degree of monopoly in relation to the industry or of the industry in relation to other industries, the greater the profit margin of that firm or industry, [36] and the greater its profit share in relation to wages in the income generated by that industrial sector. [37] In these highly concentrated firms or industries, the labor force, like capital, is more organized and united. There, the existence of high profit margins encourages labor unions to fight for better wages, since they are aware that such firms and industries are in a position to meet their demands, causing the reduction their profit margin, in which would be much higher still, in the absence of unions. [38]

The segmentation of the labor market has served as a solution to these conflicts in that is has provided a hierarchical, bureau-

34 *Ibid.*, p. 39.

35 See P. Sylos-Labini, *Oligopoly and Technical Progress* (Cambridge, Massachusetts: Harvard University Press, 1969), Chaps. 5 and 6.

36 See M. Kalecki, "Costs and Prices" in *Selected Essays...*, *op. cit.*, pp. 43-61.

37 See M. Kalecki, "Distribution of National...", *op. cit.*, pp. 62-77.

38 See Michael Kalecki, "Class Struggle and Distribution of National Income", in *Selected Essays...*, *op. cit.*, pp. 62-77.

cratic mechanism of control over the labor force, through disciplinary arrangements, cooptation and/or coercion of labor, production lines, etc. These arrangements, "on the other hand, are forms which permit the development of objective (some would say scientific) criteria for evaluating the performance of the worker in the context of a collective production effort in which it is impossible to systematically identify the contribution of each individual. These criteria are important to legitimize the rules, including those concerning wage differentiation, imposed by the firm". [39] "The continual refinement of the segmentation process set to one side the various groups of internal positions, which are relatively isolated and, therefore, privileged. These markets shared the advantage of having career ladders, promotion standards, pre-established access levels and mechanisms, even to the knowledge of the unions. On the other side, are workers outside the firm and, therefore, ineligible for career positions; they are generally relegated to the less important tasks related to simpler activities, with lower wages". [40]

3.1.4 — Brazil: a case apart

The process of labor force segmentation, as described above, reflects concrete situations having arisen during the development of capitalism in the most advanced nations. Very little empirical and/or theoretical research has been done on the manner in which this process has taken place in countries such as Brazil, for example, where the past thirty years have brought about many profound transformations. Rapid development and segmentation of industrial production occurred in the post-war period brought about by a governmental industrialization policy. This policy was essentially supported by the transfer of foreign capital and technology to Brazilian industry, and governmental interference in the control of union organizations (in a paternalist manner until 1964, and in the form of police-control in the post-1964 period.) [41] These mechanisms made possible the implementation of a restrictive wage policy. The type of labor market segmentation which resulted from such a development process was clearly unlike that which took place in the more advanced countries.

39 Paulo Vieira da Cunha, *op. cit.*, p. 39.

40 *Ibid.*, p. 40.

41 See Maria Hermínia Tavares de Almeida, "O Sindicato no Brasil: Novos Problemas, Velhas Estruturas", in *Debate e Crítica*, no. 6 (July, 1975), pp. 49-76, and John Humphrey, "Operários da Indústria Automobilística no Brasil: Novas Tendências no Movimento Trabalhista", in *Estudos CEBRAP*, no. 3 (1979), pp. 82-163.

Initially, the foreign companies which were established in Brazil brought with them not only large amounts of capital (in comparison with domestic firms) and production techniques already developed in their countries of origin, but also transferred hierarchical administrative procedures which required the specialization and individualization of labor in production. In practice, a transfer of the technical and social relations of production took place, doubtlessly increasing the value of capital, both by virtue of the weak economic and financial competition of domestic private firms as well as by weak labor union organization. [42]

At the same time, during the establishment of this new industrial complex, there was a temporary scarcity of specialized labor, creating a privileged group of workers and administrators, principally in terms of wages and promotions. This group was the embryo of the internal labor market. In the period after 1964, tight controls were place on unions and the middle strate of the population was favored. The segmentation of the labor market crystallized, exacerbating the anticipated privileges, especially in terms of wage dispersion. This was partially the result of the government's wage policy which established the fixing of a minimum wage for the non-privileged group of workers (the external labor market). This minimum wage would have otherwise received market pressure from the supply side (scarcity, strikes, etc.). On the other hand, managers, [43] acting as intermediaries between workers and capitalists, and utilizing their hierarchical power, adopted corporate interests as their own and considered the company's performance in terms of profitability and productivity as fruit of their own performance. They established higher salary levels for themselves and for those ranking close to their hierarchical position, as was the case of the workers who occupied positions at the highest levels of company hierarchy, i.e. functions requiring highly skilled labor. [44]

Base upon this theoretical formulation, we will attempt to interpret the segmentation of the labor force in the Brazilian manufacturing industry, as well as the wage structure and the wage trend in the period covering 1970-1974.

42 One must remember the strict financial limitations implemented with the monetary stabilization policy of the period 1964 to 1967, which resulted in the bankruptcy of many domestic (Brazilian) firms.

43 Classification which includes administrators and supervisors.

44 See Edmar L. Bacha, "Hierarquia e Remuneração Gerencial..., *op. cit.*

3.2 — The origins, treatment and appropriateness of data on labor and wages and of the indicators of industrial structure and performance

The statistics on labor and wages used in this part of the paper were taken from the questionnaires of the Law of the 2/3, as published by the Ministry of Labor, and refer to the months of April from 1970 to 1974.[45] The results refer to the manufacturing industry, disaggregated by branches, with laborers classified into 17 wage groups.[46] For the purposes of this paper, the statistics on labor and wages for each branch were segmented into two major wage groups, having as reference the average wage of the industrial branch for each year. The group of workers receiving "low wages" (Group B) is comprised of those workers at lower wage levels, until the group which receives the average wage of the industrial branch in the year under examination. The group of those who receive "high wages" (Group A) is composed of those included in the wage groups above the average wage of the industrial category in the year in question.

The rationale for this procedure has a theoretical as well as practical origin. First, the information available did not allow for a characterization of the segmentation of the labor force in a theoretically correct manner for which it would be necessary to know the specific situations of each job.[47] It was decided, then, to characterize this segmentation by one of its possible consequences, i.e., the wage level. Thus, the group of workers receiving low wages (Group B) could be identified as belonging to the external labor market, while the group receiving high wages (Group A) would be included in the internal labor market. Nevertheless, care should be taken with this generalization. Many highly paid occupations may be, according to their characteristics, occupations typical of the external rather than internal market. Nevertheless, it is expected that, for the most part, the higher pay-internal market, lower pay-external market ralations prevail.

45 See Ministry of Labor-General Secretariat, *Boletim Técnico do Centro de Documentação e Informática* (CDI), various issues.

46 The wage groups are distributed from "less than 140 cruzeiros to" more than 2.400 cruzeiros, in current values, and have been maintained unchanged for some time. The branches of the manufacturing industry are similar (the slight differences are mentioned in the tables) to those of the standard industrial classification of the UN, adopted by the IBGE.

47 An empirical study on Brazil along these lines is the paper by Samuel A. Morley, Milton Barbosa and Maria Cristina Cacciamali de Souza, "Evidência no Mercado Interno de Trabalho durante um Processo de Rápido Crescimento Econômico", in *Estudos Econômicos*, vol. 7, no. 3 (1977), pp. 61-101.

Second, the wage level of the company or factory, as a point of reference in relation to other companies or industries, is one of the three dimensions of the internal wage structure theoretically identified. This observation, made for the case of the United States, also has validity for Brazil. In interviews with entrepreneurs of the manufacturing industry, reference has been made to two wages levels within the firm: [48] a) the company's minimum wage, which is the base-wage or even the firm's wage rate; and b) the average wage of the firm, as reference to the wage pattern *vis-à-vis* other companies and industries. The use of the minimum wage in the industry under examination (here referred to as branch of the manufacturing industry), or some multiple of this wage as point of reference to characterize the segmentation of the labor force in external and internal markets, is subject to two limitations: a) What value is adopted for this minimum wage of the industry?; and b) Even using the official minimum wage as base-wage, what multiple of this wage characterizes the upper limit of the external labor market? On the other hand, although the average of the industrial branch may not be totally reliable, it is a more general and empirically determinable point of reference for each industry.

As indicators of structure we chose: a) the degree of monopoly in each branch, measured by the Gini coefficient of the concentration of production, calculated with the distribution of the number of plants by size of the value of production; [49] b) the degree of capital intensity (physical capital/labor ratio), measured by the volume of electric energy consumed in industrial operations by production personnel; and c) the market power of foreign companies in the sector, measured by the index of dominance of these companies and by the foreign firms' percentage share of the value of production of the sample of leading companies.

The performance indicators used are as follows: a) the gross profits/value of production (profit margin ratio); b) an indicator of employees' productivity measured by the *valor da transformação industrial* (VTI); and c) the percentage variation in the real value of production. As an indicator of the functional distribution of yelds, we used the gross profits/total wages ratio. [50]

The comparability of data from the Law of the 2/3 with the data from the IBGE (Demographic Census and Industrial Research)

48 These interviews are part of a broader study on price formation in the manufacturing industry, currently being conducted.

49 In this case only the coefficient relating to 1970 was considered, since 1974 showed serious distortions, as mentioned in note 18.

50 The sources and methodologies of calculation of these indicators of structure and performance appear in the respective tables.

does not appear to present any problems. First, examining the names used, they were observed to be identical, indicating that the classifications corresponded. One problem arises, due to the fact that the information from the Law of the 2/3 is collected at the company level: some companies can be simultaneously classified in different industrial categories. This difficulty is overcome by the IBGE by using data from the companies themselves, referring to the "lines of production." Nevertheless, in attempting to avoid cases in which this overlap is more frequent, the classification of the data of the Law of the 2/3 groups of the branches of Mechanics and Electric Machinery and Parts, as well as Chemicals and Pharmaceuticals, isolating the only activity of Chemicals clearly differentiable from Pharmaceuticals, which is the Petroleum Derivatives industry. It was decided to use the data from the IBGE, grouping the categories in the same manner as the data of the Law of the 2/3.

Second, one can argue about the comparability of the samples: the tabulations published from the Law of the 2/3 are based on expanded sample whereas the census directly tabulates the data of the universe, and the Industrial Study does it directly with the data of a sample of firms, whose selection criterion is having more than five employees and/or a product value greater than 640 times the highest minimum wage in effect in the year of the survey. The form in which the census data are published permits working with a sample whose selection criteria are identical to those of the *Pesquisa Industrial* (Industrial Research Study). With respect to the tabulation of the data of the Law of the 2/3, the question is not as simple. However, assuming that the selection criteria and later expansion of the sample tabulated are statistically reliable, the discussion moves to the question of the representativity, which can be tested more easily. Thus, it is found that, according to tabulations of the Law of the 2/3, the number of employees in the manufacturing industry in the month of April, 1970 equaled 2,498,682. This number is slightly higher than the monthly average of people employed (which was 2,381,810 in the census tabulations) according to the criterion of the Industrial Study, representing 97% of the universe registered in the census. With regard to the month of April, 1974, the tabulations of the Law of the 2/3 indicate a total of 3,781,186 employees in the manufacturing industry, which is also slightly higher than the monthly average of people employed, as shown by the Industrial Study, which was 3,336,159.

3.3 — The composition of the labor force and the wage structure: empirical aspects of the technical and social determinants

With some qualifications, available statistics furnish empirical evidence in support of the theory elaborated in this paper. In this subsection, rather than examining the trend in labor force composition and wage structure, we attempt to sketch a particular picture and analyze its determinant elements.

3.3.1 — Composition of the labor force: its technical and social determinants

As was pointed out in Subsection 3.2, the data used here allow for the characterization of the segmentation of the labor force only by wage level and, more narrowly still, by the wage level of groups of workers, rather than individual workers. Due to the manner in which the data from the Law of the 2/3 are tabulated, we chose to divide the workers of each branch of the industry into two groups (high and low wages), in such a way that the percentage composition necessarily varies from year to year in each industrial branch. Since this variation within each category is fundamentally of a statistical nature, we attempted to neutralize it by working with the average labor composition of the period from 1970 to 1974, to be followed by an analysis of the differences between the industrial categories.

As noted above, the labor force composition between the internal and external markets possesses historically determined technical and social roots and, as such, should not vary considerably in the short-run. Therefore, the utilization of the average requires that the variations in each year around this average be small. Unfortunately, the limited number of observations (5) does not facilitate the checking of the significance of that average. Despite this limitation, we believe that, for the purpose of comparison between industrial categories, the average can be a good measure of labor force segmentation for this period.

As can be seen in Table 2 (EA/TE), the high wage group within the total of the manufacturing industry includes, on the average, 24% of the labor force during the period 1970 to 1974 (with small variations between 22 and 25%), while the remaining 76% were included in the low wage group. Industrial categories having a labor contingent in the low wage group (below the average for the manufacturing industry) included Tobacco, Rubber Goods, Metals, Vehicle Construction and Repair, Petroleum Derivatives, Chemicals

and Pharmaceuticals. Those industries with labor contingents equal to or above that average included Furniture, Printing, Textiles, Spinning and Weaving, Non-Metallic Minerals, Leather and Hides, Paper and Cardboard, Plastics, Clothing and Footwear, Food Products, Miscellaneous and Wood.

The first group of industries (whose share of workers with high wages is greater than that of the industry's average) is composed of those industries having played the most dynamic role in recent Brazilian development. [51] They are also the more sophisticated industries, both technologically as well as in terms of the final product. [52] In this group, the presence of multinational firms and even state-owned firms among the leading firms is outstanding. [53] These industries also display higher concentration in terms of production, productivity, and profit margin. [54]

In the second group, the share of workers receiving high wages is lower than that of the average for the manufacturing industry. This group is composed principally of the so-called traditional industries, whose structural and performance characteristics are the inverse of those of the first group. The leading firms within this group are predominantly privately owned domestic.

3.3.2 — The wage structure: its technical and social determinants

The industry's wage structure, though resultant of the labor force segmentation and its technical and social determinants, is also subject to short-run political variables. As opposed to other societies where the theory of the internal labor market may have better application, Brazil has been subject to constant alterations in the political conditions capable of rapidly altering the wage structure, despite the relative short-term rigidity of the composition of the labor force. This being the case, although the technical and social determinants may have maintained their structure during the period, wages may not have. Taking these aspects into consideration and seeking to reduce chance results, we chose to characterize the wage structure for the years 1970 and 1974, especially since these were the extreme

51 Consult table 6 for data on the period 1969 to 1974 in relation to several branches.

52 In technological terms, the mechanization index already mentioned, available in table 1, can be considered as the capital/labor ratio.

53 See Maria da Conceição Tavares, Luiz Otávio Façanha and Mario Luiz Possas, "Estrutura Industrial e Empresas Líderes" (Rio de Janeiro: FINEP, 1978), mimeo, for a broad study on the origin of industrial capital in Brazil. Some data in this regard appear in table 5.

54 See tables 3 and 4.

years. Subsequently, we shall compare the results of the structure with those of the trend.

All of the information on wages which will be used to analyze the five-year period in question is contained in Table 2. First note that the structures for 1970 and 1974 are quite similar. Taking the total average wages (TAW) of the low wage group (AWB) and of the high wage group (AWA), and the wage dispersion (AWA/AWB/SMB) by size order, one finds a quite significant correlation between 1970 and 1974 for these indicators. [55]

Between 1970 and 1974, the wage structure, as well as its technical and social determinants, [56] remained essentially unchanged, with the exception of the slight alteration of the dispersion coefficient. Therefore, as would be expected in the short-run, the tests of correlation between the wage structure's relations of determination (conducted for the two years simultaneously) will have considerable strength by reducing considerably the degree of chance inherent in these types of correlations.

Inter-relating the observations made concerning the composition of the labor force, we note that the eight industrial branches reported as possessing a share of the internal labor market greater than the manufacturing industry's average, also paid total average wages (TAW) higher than that of the average for the industry in 1970. This situation which remained nearly unchanged for each year. [57] The result is the same for the eight industrial categories in reference to the average wages of the low wage groups (AWB) and the high wage groups (AWA) although it is more the case of the former than of the latter. In terms of the wage spread within each industrial category, there is no correspondence between these eight categories and a greater or lesser dispersion (measured by AWA/AWB).

The following hypothesis is drawn from this observation and from the theoretical indications developed for the case of Brazil (to be tested below): although the elements of both the structure and

[55] The values of the Spearman coefficient between 1970 and 1974 are: for TAW, 0.99; for AWB, 0.97; for AWA, 0.91; and, for AWB/AWA, 0.81, all significant at the 1% level.

[56] The values of the Spearman coefficient between 1970 and 1974 were: for the capital to labor relation, 0.96; for the profit margin, 0.72; for productivity, in terms of the value of production, 0.92, and, to the *valor da transformação industrial* (VTI): 0.89; and for the profits to wages ratio, 0.70, all significant at the 1% level. For the other untested indicators 1974 data are not registered.

[57] In fact, with the exception of Beverages in 1972 and Rubber and Beverages in 1974, in which total averages wages are slightly lower than the average for the industry, the total averages wages of each of these eight industrial categories is higher than the average wage of the industry in every year.

performance of the industry affect the composition of the labor force, this composition likewise affecting the wage scale, in the case of Brazil, these influences have manifested themselves in an unusual manner. At the risk of oversimplification, it can be stated that, due to factors of social and political order, the elements of performance have substantially affected the wage scale via income distribution. In other words, as we will see below, it is expected that the wage scale be explained by the same elements of structure which describe the composition of the labor force, but that the wage dispersion be explained by performance indicators which determine the distribution of incomes among industries, as well as between capital and labor within each industry.

In order to present the empirical evidence which was obtained, we chose to return to the theoretical formulation for isolated relations for which data was available, and to then present the results corresponding to the two years in question. An attempt was made to order these isolated relations of expected results according to their priority, although acknowledging that they are too interconnected for an order of priority to be clearly established in some instances. Although the results of some of these relations have already been mentioned, we have chosen to call attention again to those which are not directly connected to the wage structure, but which are capable of intervening indirectly in it.

3.3.2.1 — Hypotheses and results

i) With respect to the relation between the determinants of structure and performance:

a) Given the important role played by foreign private companies in Brazilian industrialization, one must consider the possibility that the major part of technology transferred by such companies has introduced into Brazil production processes technologically designed to reproduce economies of scale conceived for countries with larger markets. In technical terms, this would necessarily result in a greater concentration of industrial production, inasmuch as a small number of companies would be sufficient to supply the domestic market. The impact of this transfer of companies on the already established Brazilian industries was devastating, for the following reasons. First, the vast range of advantages and incentives granted by the Government to attract foreign capital during the period of 1955 to 1970; second, the economic and financial weakness of the domestic private company; and, finally, the stabilization policy (reduction in official credits) during the period of 1964 to 1967.

As a result of these factors, there was an increase in the concentration of industrial production, especially in those industries in which the percentage of foreign companies was higher. It is noteworthy that in 1970, the greater the share of capital of foreign companies in the industrial sector (Table 5), the greater the index of concentration of industrial production (table 1).[58]

b) As a result of the analysis developed in *a*, it would be expected that the branches in which concentration is greater would be those having more mechanized production processes. Observe in Table 1 that in 1970, the index of concentration of industrial production by industrial branch is closely associated with the capital/labor ratio (energy per person employed).[59]

c) Consequently, productivity is also greater in the more concentrated branches, though not only as a result of using more capital per unit of labor.[60] We must not overlook the fact that average productivity, measured in monetary terms (as is done here), rather than in physical terms, is subject to the great influence of market power, represented by the index of concentration. The capacity of a firm (and therefore of an industry) to generate more income (value-added = profits + wages) per unit of labor (productivity)

58 The value of the Spearman coefficient between these indicators was calculated for two measures of the share of foreign capital: the dominance • index and the percentage share. In the case of dominance index, two correlation coefficients were calculated; since the dominance index is zero in several branches, two criteria were adopted: for the first coefficient, those branches for which the coefficient was zero were abandoned: for the second coefficient, we estimated the order of dominance by the order of importance of foreign capital firms in terms of the product value. In both cases, obeying the criteria of grouping of branches, it was necessary to estimate the dominance index in the following branches: Mechanics and Electrical and Communications Equipment (grouped together) (33%) and that of the branches Chemicals, Pharmaceuticals and Cosmetics, Soaps and Candles grouped together (20%), which were not available. With these alterations, the number of data of the first coefficient was 13 and that of the second was 18, with the values of, respectively, 0.58 and 0.52, both significant at the 2% level. In the case of the percentage share of foreign firms in the value of production of leading firms of the branch, the estimated value of this share in the grouped Mechanics, Electrical and Electronic Equipment categories was 78% and for grouped Chemicals, Pharmaceuticals and Cosmetics, was 50%. The number of data considered was 18 and the coefficient of correlation was 0.58, significant at the 1% level.

• See table 5, footnote *a*.

59 The value of the Spearman coefficient was 0.63, significant at the 1% level.

60 The value of the Spearman coefficient between the ratio of capital to labor (Table 1) and average productivity (Tables 3 and 4: value of increase due to the production process per total employed individuals) in 1970 and 1974 was, respectively, 0.51 and 0.54, both significant at the 2% level.

than others is closely associated with its market power *vis-à-vis* other companies. [61]

d) Finally, the association of the above-mentioned factors would bring the branches with a greater capital/labor ratio to generate a larger profit share. As pointed out in Subsection 2.3, this relation is strong in 1959, diminishes in 1970 and becomes insignificant in 1974, by reason of the distortions provoked by the wage policy adopted during the post-1964 period.

ii) With respect to the determination of the composition of the labor force and of the wage structure by the elements of industrial structure and performance:

a) The development of technical relations of production resulted in the increased size of the companies, requiring that they develop their own mechanisms to control, distribute and pay labor, which, unionized, came to demand a greater share in the extra profits obtained through economies of scale and market positions. The continuous development of this mechanism of hierarchical-bureaucratic control of the labor force gave rise to both the progressive grouping of the various sets of internal positions and external positions ineligible for career appointments.

For the reasons described above, one would expect that the more concentrated firms (and, consequently, industries) should have a larger internal labor market apparatus, either due to the need to organize the labor force (or to control and coopt it, were the labor unions to be more strongly organized). Thus, it can be observed that in 1970, the largest indices of concentration of industrial production (Table 1) correspond to larger shares of the internal labor market (Table 2: EA/TE). [62]

b) As was previously observed, the creation of internal labor markets was not only a response to the development of technical relations of production (more capital-intensive technologies). The effect of this phenomenon taken alone would probably only be to render the labor force more standardized, at a lower level. Note that, in both 1970 and 1974, the greater degree of mechanization (Table 1: capital/labor ratio) did not by itself result in a larger number of more highly skilled laborers, which is to say, a larger internal labor market (Table 2: EA/TE). [63]

[61] The value of the Spearman coefficient between the index of concentration (Table 1) and the *valor da transformação industrial* (VTI) per total employed individuals (Table 3) in 1970 was 0.75, significant at the 1% level.

[62] The value of the Spearman coefficient between these variables is 0.52, significant at the 2% level.

[63] The values of the Spearman coefficient were, for 1969 and 1974, respectively, 0.05 and 0.39, both not significant.

Table 2

Average Wages by Wage Groups, Wage Dispersion and Composition of the Labor Force by Wage Groups, by Branches of the Manufacturing Industry from 1970 to 1974

(Values in Current Cr$)

Industrial Branches	1970					1971					1972				
	TAW (Cr$)	AWB (Cr$)	AWA (Cr$)	AWA/ AWB	EA/TE (%)	TAW (Cr$)	AWB (Cr$)	AWA (Cr$)	AWA/ AWB	EA/TE (%)	TAW (Cr$)	AWB (Cr$)	AWA (Cr$)	AWA/ AWB	EA/TE (%)
Non-Metallic Minerals	301.10	199.20	824.56	4.120	16.3	358.40	224.37	805.34	3.590	23.0	478.30	272.79	1,105.25	4.050	24.7
Metallurgy	457.60	292.46	898.30	3.070	27.3	540.40	344.63	1.061.13	3.080	27.3	701.70	440.57	1.476.20	3.350	25.2
Electrical and Electronic Equipment and Mechanics	434.60	257.54	1.021.2	3.970	23.2	520.50	303.15	1,258.95	4.150	22.7	586.50	334.37	1,144.31	3.420	31.1
Vehicle Construction and Repair	609.46	365.31	1.038.82	3.580	25.8	716.70	409.18	1,492,62	3.650	28.4	927.30	515 33	1.897.65	3.680	29.8
Wood (except Furniture)	207.30	158.45	517.66	3.270	13.6	255.20	185.49	582.38	3.130	17.5	315.50	230.71	729.11	3.160	17.0
Furniture	284.70	178.19	555.45	3.117	28.2	315.20	224.13	606.24	2.700	23.8	418.80	277.47	914.46	3.300	22.2
Paper and Cardboard	333.90	216.41	778.17	3.600	20.9	421.00	268.57	1,108.11	4.130	18.2	527.00	316.68	1.332.61	4.210	20.7
Rubber Goods	392.30	219.21	805.80	3.680	29.5	473.60	268.16	1,024.05	3.820	27.2	581.90	321.80	1,215.53	3.780	29.1
Leather and Hides	247.90	177.30	551.47	3.110	18.9	293.00	195.19	575.21	2.950	25.7	359.00	249.91	722.36	3.090	20.9
Petroleum Derivatives, Coal, Chemicals and Pharmaceuticals	620.60	336.84	1.469.14	4.360	26.6	723.46	402.61	1,782.62	4.430	23.2	948.80	501.14	2.360.11	4.710	23.7
Plastics	327.00	205.88	796.40	3.870	20.5	415.70	248.09	1,122.79	4.530	19.2	517.80	300.78	1,365.35	4.540	20.4
Textiles, Spinning and Weaving	285.54	178.54	566.26	3.170	27.3	349.38	224.94	786.63	3.500	22.2	432.05	276.12	978.44	3.540	22.2
Footwear and Clothing	231.20	172.68	539.35	3.120	15.9	275.50	190.54	527.98	2.770	25.2	340.50	244.10	795.20	3.110	18.7
Food Products	244.80	171.26	591.05	3.450	17.5	303.61	214.65	809.10	3.770	15.0	384.71	246.62	861.33	3.490	22.6
Beverages	367.09	221.5	731.43	3.310	28.6	444.09	266.98	978.84	3.670	24.9	559.93	327.48	1,200.66	3.670	26.9
Tobacco	370.76	181.90	800.74	4.170	29.4	413.27	228.97	940.77	4.110	25.9	590.94	312.32	1,198.52	3.840	31.4
Printing	405.00	251.96	909.03	3.610	23.3	470.10	268.12	931.44	3.470	30.4	626.30	349.40	1,446.10	4.140	25.3
Miscellaneous	280.60	168.50	679.06	4.030	22.0	316.70	208.36	864.57	4.150	16.5	417.30	254.49	1,208.93	4.750	17.1
Manufacturing Industry — Total	360.54	210.58	847.73	4.026	23.5	431.00	254.13	1,057.54	4.161	22.0	571.00	310.58	1.361.24	4.383	24.8
Non-Metallic Minerals	582.40	332.33	1.369.10	4.120	24.1	775.10	422.83	1.928.43	4.560	1.523.4	499.06	290.45	1.206.54	4.150	21.3
Metallurgy	852.20	488.32	1.790.22	3.670	28.0	1.185.40	640.10	2.655.75	4.150	1.827.1	747.46	441.27	1.576.32	3.570	27.1
Electrical and Electronic Equipment and Mechanics	829.80	448.05	2.013.67	4.480	24.3	1,102.10	587.36	2.810,27	4.780	1,223.2	694.68	386.29	1.649.68	4.270	25.0
Vehicle Construction and Repair	1.166.90	618.48	2.488.91	4.020	29.3	1.672.20	968.44	4.455.60	4.600	320.2	1,018.52	575.36	2.328.72	3.910	26.7
Wood (except Furniture)	405.30	284.37	1.088.93	3.830	15.4	535.10	343.47	1.267.50	3.690	620.7	344.28	240.58	837.12	3.480	17.1
Furniture	541.90	328.86	1.218.90	3.710	23.9	725.60	422.92	1.750.53	4.140	1.122.8	457.24	286.31	1.009.12	3.520	24.0
Paper and Cardboard	689.70	377.67	1.594.02	4.220	25.6	429.70	509.44	2.427.81	4.770	1.021.9	580.30	337.95	1.448.14	4.290	21.7
Rubber Goods	780.40	405.47	1.678.15	4.140	29.5	961.20	513.30	2,254.71	4.390	1.625.7	637.88	345.59	1.395.65	4.040	28.1
Leather and Hides	442.40	307.39	905.91	2.950	22.6	618.30	398.88	1.472.43	3.710	520.6	392.12	265.36	855.48	3.220	21.7
Petroleum Derivatives, Coal, Chemicals and Pharmaceuticals	1.229.18	596.18	3.127.15	5.240	25.0	1.744.34	762.59	4.417.07	5.790	1.726.8	1,129.47	545.80	2.880 26	5.280	25.0
Plastics	659.00	350.40	1.811.57	5.170	21.1	820.30	456.87	2.122.42	4.650	421.8	547.96	312.40	1.443,71	4.620	20.8
Textiles, Spinning and Weaving	547.92	337.24	1.244.80	3.690	23.2	711.70	427.67	1.801.71	4.210	720.7	465.12	288.90	1.075.57	3.720	23.0
Footwear and Clothing	486.30	305.36	1.087.60	3.560	20.6	562.20	358.17	1.322.59	3.693	821.6	375.34	254.17	847.34	3.330	20.4
Food Products	498.42	302.14	1.172.79	3.880	22.5	644.94	386.77	1.660.98	4.290	420.3	415.31	264.30	1.019.05	3.860	19.7
Beverages	760.41	402.87	2.043.27	5.070	21.8	947.35	510.81	2.337.30	4.580	1.423.9	615.77	345.88	1.458.32	4.220	25.1
Tobacco	768.97	413.46	1,577.62	3.820	30.5	985.65	456.33	2,512.02	5.500	1.525.7	625.92	320.60	1.405.04	4.390	28.4
Printing	833.00	436.98	1.966.63	4.510	25.9	1,216.60	639.35	4.445.86	6.950	116.2	710.20	389.06	1.939.81	4.990	23.5
Miscellaneous	557.80	321.69	1.517.24	4.720	19.8	701.70	403.60	2.028.80	5.030	218.3	454.82	271.33	1.259.72	4.640	18.6
Manufacturing Industry — Total	718.70	388.05	1.849.04	4.765	22.6	985.30	488.35	2.468.98	5.056	225.1	613.30	398.26	1.516.90	4.478	23.6

SOURCE: Original data from the Law of the 2/3, published in Ministry of Labor, Secretariat-General, *Boletim Técnico do Centro de Documentação e Informática*, various issues.

OBS: The total for the manufacturing industry was obtained by adding the various sectors. The methodology for the division by wage groups appears in the text.

OTES: TAW : total average wage;
AWB : average wage of group B (low wages);
AWA : average wage of group A (high wages);
AWA/AWB : measure of dispersion;
EA : employees of group A (high wages);
TE : total employees;
EA/TE : share of employees of group A in relation to total;
EB/TE : share of employees of group B in relation to total (calculated by subtracting EA/ET from 100%).

c) The fact that a greater degree of monopoly supposes greater organization on the part of the labor force itself results in the fact that in these firms (and, consequently, in these industries), negotiations for better working conditions, and principally better wages, are more hard-fought than in firms subject to more competitive market conditions. This is due to the fact that the workers are more conscious of the capacity of the more monopolistic firms to meet their demands. Thus, the average wages in firms with greater degrees of monopoly are higher than those in fellow firms in more competitive markets.

Although labor union activity in Brazil has been kept under strict control, wage pressures arising from greater industrial concentration-greater organization of the labor force cannot be ignored. Several organized manifestations of labor movement emerged, despite restrictions of labor legislation which were in effect at the time. Such were the strikes in Contagem and Osasco in 1968, in industries connected to the metal workers union (those with the highest index of concentration) and can be identified as indicators of this phenomenon. The successful strikes by these industries in 1979 are indicators that union reorganization has been taking place over time, rather than appearing suddenly. In addition, there have been other, more subtle and informal manifestations of labor unrest, not of a nature to provoke punitive action, but serious enough to concern high-level management of businesses or industries. Such manifestations include, for example, decrease in productivity, poor workmanship, etc. [64]

It can be observed that, in 1970, there was a close association between industrial branches with higher indices of concentration of production (Table 1) and industries paying higher total average wages (Table 2: TAW). [65] Furthermore, the greater organization of the labor force brought about by greater industrial concentration benefitted both wage groups: the association, in 1970, of greater indices of concentration with higher wages of workers in the internal labor market (Table 2: AWA) is only slightly greater than that with higher wages of workers in the external labor market (Table 2: AWB). [66]

d) By reason of the fact that greater concentration (degree of monopoly) is accompanied by higher indices of productivity (see

64 See John Humphrey, *op. cit.*, and Maria Hermínia Tavares de Almeida, *op. cit.*

65 The value of the Spearman coefficient was 0.72, significant at the 1% level.

66 The values of the Spearman coefficient were, respectively, 0.76 and 0.72 both significant at the 1% level.

item *i*, letter *c*), and since it represents greater bargaining power of the workers (see item *ii*, letter *c*), one would expect that industries having greater productivity (in this case, economic rather than merely technical performance) would pay higher total average wages. Note that, both in 1970 and 1974, industries with greater *valores da transformação industrial* (VTI) per unit of labor (Tables 3 and 4) paid higher total average wages (Table 2: TAW).[67] In addition, in 1970 as well as in 1974, productivity has a greater influence on the average wages of the internal labor market group (AWA) than of the external labor market group (AWB), although it is important in both.[68]

e) Furthermore, those industries with greater profit margins (Tables 3 and 4: profit/value of production ratio) generally paid their workers better (Table 2: TAW), both in 1970 and 1974.[69] Nevertheless, although there is a significant association between profit margin and average wages of the high wage group (Table 2: AWA), the same does not occur in the case of the average wage of the low wage group (Table 2: AWB).[70]

The relations observed in item *ii*, letters *d* and *e*, provide indications that workers in the internal labor market were particularly benefited. It appears as if the performance of the firm, both in terms of productivity as well as in terms of profit margin, was du principally to the performance of internal market workers, therel justifying higher wages for them. However, according to the thec which has been formulated, these higher wages were due primari to the hierarchical position which these workers occupy in the firm Thanks to this position, they succeed in securing for themselves part of the increases in productivity and in the profit share which, as we have seen, were considerable in the post-1964 period, with the implementation of a restrictive wage policy.

f) Although wages were, on the whole, contained, the same did not apply in all cases. As we will see in the next section, high

67 The values of the Spearman coefficient for 1970 and 1974 were, respectively, 0.82 and 0.80, both significant at the 1% level.

68 The values of the Spearman coefficient for 1970 and 1974 were, respectively, with AWA, 0.79 and 0.78 and, with AWB, 0.73 and 0.75, all significant at the 1% level.

69 The values of the Spearman coefficient for 1970 and 1974 were, respectively, 0.49 and 0.52, both significant at the 5% level (in 1974 the categories Transport Equipment and Wood were deleted, since they distorted the correlation).

70 The values of the Spearman coefficient for 1970 and 1974 were, respectively, with AWA, 0.56 and 0.54, significant at the 1 and 2% levels, respectively (for 1974 the categories Transport Equipment and Wood were deleted); with AWB, 0.34 and 0.42, both not significant (for 1974 the categories Transport Equipment and Wood were omitted).

Table 3

Relations of Structure and Performance by Branches of the Manufacturing Industry for 1970 (Firms with Five or more Employees and/or the Value of Production Greater than 640 Times the Highest Minimum Wage in Effect during the Year of the Survey)

Industrial Branches	Coefficient of Concentration[a] (Gini)	Profits[b] / Wages	Profits[b] / Product Value	Product Value / Direct costs[c]	Product Value / Employees	Valor da Transformação Industrial (VTI) / Employees	Product Value / Production Personnel	Valor da Transformação Industrial (VTI) / Production Personnel
Manufacturing Industry: Total	0.851	2.303	0.243	1.542	46.76	21.37	59.40	24.90
Non-Metallic Minerals	0.882	2.110	0.323	1.966	23.30	15.07	27.45	17.08
Metallurgy	0.874	2.274	0.225	1.480	56.13	23.76	60.54	27.32
Mechanics	0.800	1.271	0.238	1.606	37.75	21.30	43.68	24.65
Electrical and Communications Equipment	0.818	1.083	0.266	1.636	48.30	25.29	56.13	29.34
Mechanics, Electrical and Communications Equipment	0.812	1.537	0.250	1.620	41.03	22.85	48.56	26.49
Transportation Equipment	0.918	1.858	0.228	1.473	61.38	27.24	71.30	31.64
Wood	0.665	1.605	0.227	1.583	21.43	10.75	24.33	12.21
Furniture	0.709	1.345	0.226	1.589	22.14	11.92	25.81	13.89
Paper and Cardboard	0.790	1.764	0.217	1.554	44.10	20.45	49.96	23.95
Rubber	0.879	3.632	0.337	1.763	61.02	32.05	71.11	37.36
Leather, Hides and Similar Products	0.747	1.774	0.204	1.495	23.20	14.02	34.77	15.55
Chemicals	0.838	4.061	0.275	1.544	123.13	51.70	156.31	65.63
Pharmaceutical and Veterinary Products, Perfumes, Soaps and Candles	0.800	5.404	0.447	2.256	84.16	53.81	119.27	76.25
Chemicals, Pharmaceutical and Veterinary Products, Perfumes, Soaps and Candles	0.836	4.441	0.317	1.673	110.62	52.38	145.29	68.79
Plastics	0.789	2.999	0.309	1.714	45.71	23.74	52.74	27.39
Textiles	0.755	1.779	0.216	1.511	31.76	14.60	34.44	15.83
Clothing, Footwear and Cloth Goods	0.715	1.619	0.205	1.487	24.57	11.16	27.55	12.51
Food Products	0.816	3.661	0.176	1.341	71.63	21.65	84.99	25.60
Beverages	0.853	2.163	0.274	1.775	40.51	22.83	54.38	30.64
Tobacco	0.825	6.193	0.480	2.222	77.45	48.59	80.30	56.02
Publishing and Printing	0.804	1.275	0.275	1.825	31.43	20.99	41.30	27.58
Miscellaneous Industries	0.750	1.928	0.301	1.824	30.72	18.68	36.13	21.96

SOURCE: Original data from *Censo Industrial de 1970.*

[a] Calculated from the distribution by classes of the product value.

[b] Profits do not exclude income tax. They were calculated by deducting total wages and miscellaneous expenditures from the total *Valor da Transformação Industrial* (VTI).

[c] Direct costs are expenditures on industrial operations + total wages.

OBS.: All other terms are defined in the original sources.

Table 4

Relations of Structure and Performance by Branches of the Manufacturing Industry for 1974 (Establishments with Five or more Employees and/or the Value of Production Greater than 640 Times the Highest Minimum Wage in Effect during the Year of the Survey)

Industrial Branches	Profits[a] / Wages	Profits[a] / Product Value	Product Value / Direct Costs[b]	Product Value / Employees	Valor da Transformação Industrial (VTI) / Employees	Product Value / Production Personnel	Valor da Transformação Industrial (VTI) / Production Personnel
Manufacturing Industry: Total	2.501	0.210	1.440	155.05	61.50	101.20	75.00
Non-Metallic Minerals	2.276	0.309	1.908	80.25	49.10	97.11	59.41
Metallurgy	2.864	0.232	1.474	184.07	74.12	220.06	88.80
Mechanics	1.227	0.205	1.405	115.70	56.73	136.96	67.54
Electrical and Communications Equipment	2.026	0.234	1.502	130.45	61.30	160.50	70.29
Mechanics, Electrical and Communications Equipment	1.485	0.220	1.503	122.16	58.44	146.35	70.67
Transportation Equipment	2.263	0.174	1.317	220.00	72.75	284.28	90.20
Wood	2.780	0.284	2.650	80.30	40.74	94.86	48.00
Furniture	1.352	0.202	1.512	74.61	35.26	86.74	42.35
Paper and Cardboard	3.631	0.274	1.570	101.00	84.47	199.28	106.34
Rubber	3.028	0.277	1.590	161.23	74.07	103.71	90.08
Leather, Hides and Similar Products	1.651	0.175	1.301	91.62	35.48	105.06	40.68
Chemicals	5.487	0.209	1.360	555.80	168.31	820.74	248.40
Pharmaceutical and Veterinary Products, Perfumes, Soaps and Candles	2.843	0.320	1.842	190.03	108.25	327.17	180.38
Chemicals, Pharmaceutical and Veterinary Products, Perfumes, Soaps and Candles	4.585	0.226	1.415	431.90	147.95	670.02	228.86
Plastics	3.100	0.304	1.706	137.85	70.63	169.41	80.68
Textiles	2.330	0.198	1.403	115.83	43.07	120.47	48.15
Clothing, Footwear and Cloth Goods	1.687	0.200	1.448	71.07	30.82	82.65	35.39
Food Products	3.181	0.152	1.282	201.56	53.94	265.50	71.07
Beverages	3.219	0.316	1.702	133.40	72.07	220.52	119.07
Tobacco	8.146	0.473	2.147	104.45	115.17	229.77	136.09
Publishing and Printing	1.836	0.333	1.880	91.38	59.32	130.51	84.71
Miscellaneous Industries	1.046	0.212	1.501	80.20	46.14	95.60	64.00

SOURCE: Original data from *Pesquisa Industrial*, 1974.

[a] Profits do not exclude income tax; they were calculated by deducting total wages and miscellaneous expenditures from the *Valor da Transformação Industrial* (VTI).

[b] Direct costs are expenditures on industrial operations + total wages.

OBS.: All other terms are defined in the original sources.

Table 5

Distribuition of the Sample of Leading Firms by Type of Ownership in Value of Production and Index of the Dominance of Firms of Foreign Capital, by Branches of the Manufacturing Industry: 1970

Industrial Branches	Foreign Capital (%)	Domestic Private (%)	Public (%)	Total (%)	Index of Dominance of Firms of Foreign Capital[a]
Non-Metallic Minerals	44.0	55.5	0.5	100.0	13.3
Metallurgy	33.0	24.5	42.5	100.0	3.0
Mechanics	70.0	24.5	5.5	100.0	27.3
Electrical Equipment	83.7	16.3	0	100.0	35.7
Transportation Equipment	88.2	10.0	1.8	100.0	40.5
Wood	23.2	75.4	1.4	100.0	2.4
Furniture	16.0	84.0	0	100.0	0
Paper	22.3	77.7	0	100.0	0
Rubber	81.1	18.9	0	100.0	57.4
Leather and Hides	37.9	62.1	0	100.0	0
Chemicals	35.7	13.8	50.6	100.0	17.4
Pharmaceuticals	100.0	0	0	100.0	12.7
Perfumes	81.5	18.5	0	100.0	27.8
Plastics	44.9	55.1	0	100.0	12.8
Textiles	34.2	65.8	0	100.0	4.2
Clothing and Footwear	29.2	70.5	0	100,0	4.8
Food Products	42.1	56.4	1.5	100.0	7.5
Beverages	30.9	69.1	0	100.0	0
Tobacco	98.7	1.3	0	100.0	58.2
Publishing and Printing	3.5	96.5	0	100.0	0
Miscellaneous	40.9	59.1	0	100.0	13.3

SOURCE: Maria da Conceição Tavares, Luiz Otávio Façanha and Mario Luiz Possas, *op. cit* Apêndice Estatístico, Tables II.10 and III.6.

[a] The index of dominance of firms of foreign capital (%) was calculated by the authors according to the formula $\Sigma C.C._i x \frac{VP_i}{VP}$, where:

i refers to the sectors (four digits in the IBGE classification), in which the number of establishments belonging to firms of foreign capital among the four largest was 3 or 4; when it was smaller than 3 the index is zero;

C.C.*i* is the coefficient of concentration (%) of the sector *i* measured by the share of the value of production of the four largest establishments in the sector's value of production; and

VPi is the value of production of the sector *i* and VP is the value of production of the industrial branch (two digits in the IBGE classification).

Table 6

Manufacturing Industry
Real Value of Production by Branches: 1969 to 1974

Industrial Branches	Indices		Percent Variation	Indices		Percent Variation
	1969	1973	1969-1973	1970	1974	1970-1974
Manufacturing Industry: Total	100.0	169.2	69.2	112.2	180.8	61.1
Non-Metallic Minerals	100.0	180.3	80.3	131.4	206.3	57.0
Metallurgy	100.0	153.8	53.8	107.3	172.7	61.0
Mechanics	100.0	184.2	84.2	107.9	229.5	112.7
Electrical and Communications Equipment	100.0	191.8	91.8	109.2	199.5	82.7
Transportntion Equipment	100.0	221.3	121.3	121.9	278.2	128.6
Paper and Cardboard	100.0	143.3	43.3	110.7	162.0	46.3
Rubber	100.0	175.9	75.9	118.1	200.7	69.9
Chemicals	100.0	210.9	110.9	120.6	217.8	80.5
Perfumes, Soaps and Candles	100.0	154.7	54.7	109.2	151.6	38.8
Plastics	100.0	186.5	86.5	107.3	204.5	90.6
Textiles	100.0	126.9	26.9	101.6	119.2	18.3
Clothing, Footwear and Cloth Goods	100.0	119.7	19.7	113.3	210.8	86.1
Food Products	100.0	143.6	43.6	108.7	148.7	36.8
Beverages	100.0	152.6	52.6	108.6	157.1	44.7
Tobacco	100.0	118.9	18.9	105.1	136.6	30.0

SOURCE: IBGE, *Indústria de Transformação, Pesquisa Mensal* (1969 to 1974).

OBS.: The compatibilization of the samples for the various years was done by the Division of General Planning (CPG) of IPEA/IPLAN. The data are deflated by the indices *of physical* production (*quantum*) originating from the same source, computed *also* by the CPG/IPLAN according to methodology described in Jair P. A. Mascarenhas and Cesar L. de Azevedo, "Indicadores Conjunturais-Metodologia do Indice do Valor Real da Produção da Indústria de Transformação", in *Boletim Econômico*, n.°s. 3 and 4 (May-August, 1974), pp. 28-30.

Table 7

Percentage Variations of Average Wages, by Wage Groups and Branches of the Manufacturing Industry: 1970 to 1974

Industrial Branches	1970—1971			1971—1972			1972—1973			1973—1974			1970—1974		
	TAW	AWB	AWA	TAW	AWB	AWA	TAW	AWB	AWA	TAW	AWB	AWA	TAW	AWB	AWA
Non-Metallic Minerals	19.0	12.2	—2.3	33.6	21.6	37.2	21.8	21.8	23.9	33.1	27.2	40.9	157.4	111.5	133.9
Metallurgy	18.1	17.9	18.1	23.8	27.8	39.1	21.4	10.9	21.3	39.1	31.1	48.3	159.1	118.8	195.6
Electrical and Electronic Equipment and Mechanics	18.8	17.7	23.3	12.7	10.3	90.9	41.5	34.3	76.0	32.8	30.8	38.6	153.7	128.1	175.2
Vehicle Construction and Repair	17.6	12.0	58.1	29.4	25.8	27.1	25.8	20.0	31.2	43.3	56.6	79.0	174.4	165.1	372.0
Wood (Except Furniture)	23.1	17.3	12.5	23.6	24.1	25.2	29.4	23.3	49.4	31.1	20.8	16.4	168.1	116.8	144.9
Furniture	10.7	25.8	9.1	32.9	23.8	50.8	28.4	18.5	33.3	33.9	28.6	43.6	154.9	137.3	215.2
Paper and Cardboard	26.1	24.1	42.4	25.2	17.8	20.3	30.9	18.3	18.6	34.8	34.9	52.3	178.5	135.4	212.0
Rubber Goods	20.7	22.3	27.1	22.9	20.0	18.7	34.1	26.0	38.1	23.2	26.6	34.4	20.1	134.2	179.8
Leather and Hides	18.2	10.1	4.3	22.5	28.0	34.3	23.2	23.0	17.3	39.8	29.1	62.5	149.4	123.9	167.0
Petroleum Derivatives, Coal, Chemicals and Pharmaceuticals	16.6	18.5	21.3	30.3	24.5	32.4	30.4	18.0	32.5	41.9	27.9	41.2	181.1	126.4	200.7
Plastics	27.1	20.5	41.0	24.6	21.2	21.6	27.3	16.5	32.7	24.5	30.4	17.2	150.8	121.9	166.5
Textiles, Spinning and Weaving	22.8	26.0	38.9	23.7	22.7	24.4	26.8	22.1	27.2	29.8	26.8	44.7	150.1	139.6	218.2
Footwear and Clothing	19.2	10.3	—2.1	23.6	28.1	43.8	36.9	25.1	43.3	21.2	17.3	21.6	144.5	107.4	145.2
Food Products	24.0	25.3	36.9	26.7	14.8	6.5	29.6	22.5	36.2	29.4	28.0	41.6	163.4	125.8	125.8
Beverages	21.0	20.7	33.8	26.1	22.7	22.7	35.8	23.0	70.2	24.6	26.8	14.4	158.1	130.7	218.5
Tobacco	11.5	19.3	17.5	43.0	36.4	27.4	30.1	32.4	31.6	28.2	10.4	59.2	165.9	137.8	213.7
Printing	16.1	6.4	2.5	33.2	30.3	55.3	33.0	24.9	36.0	46.1	46.5	126.1	200.4	153.8	388.1
Miscellaneous	12.9	23.7	27.3	31.8	22.1	39.8	33.7	26.4	25.5	25.8	25.5	33.7	150.1	139.5	198.8
Manufacturing Industry: Total	19.6	20.7	24.8	32.5	22.2	28.7	25.8	24.9	25.8	37.1	25.8	33.5	173.3	131.9	191.3

SOURCE: Table 2.

OBS: The variations are positive, indicated to the contrary.

AWB, AWA, TAW: respectively, average wages of the low and high wage groups and the total.

wages rose considerably more than low wages, resulting in a substantial increase in the dispersion between them. This was the result, on the one hand, of the containment of low wages through the setting of the base-wage (minimum wage). On the other hand, the resulting increase in the share of profits was partially distributed throughout the high wage group (as seen in item *ii*, letter *e*).

With reference to the first point, although the link between the minimum wage and the average wage of the external labor market will be discussed in detail in the following section, it is important to note that, on the average, in the period 1970 to 1974, the average wage of the low wage group in the manufacturing industry (Table 2: AWB) is equal to 1.2, the average of the minimum wages of equal period (Table 8).

As can be observed, in 1970 and 1974, greater profit margins (Tables 3 and 4: profit-value of production) are associated with greater wage dispersions (Table 2: AWA/AWB). [71]

Table 8

Minimum Wage and Cost of Living Index: 1970 to 1974

Periods	Minimum Wage in April[a]		Cost of Living Index in São Paulo (1970 = 100)	
	Current Cruzeiros (Cr$)	Percentage Variation in Relation to the Previous Year	Index	Percentage Variation in Relation to the Previous Year
April 1970	183.88		100.0	
April 1971	222.74	21.3	124.9	24.9
April 1972	265.55	19.2	153.0	22.5
April 1973	309.50	16.5	193.9	26.7
April 1974	371.71	20.1	262.2	35.2

SOURCE: Legal Decrees, published in the *Diário Oficial* and *Boletim do DIEESE*, various issues.

71 The values of the Spearman coefficient for 1970 and 1974 were, respectively, 0.80 and 0.51, significant at the 1 and 5% levels (for 1974 the categories Transport Equipment and Wood were deleted).

3.4 — Trend in industrial wages and the wage structure during the period 1970 to 1974

As was previously noted, the stabilization policy dictated by economic authorities in the post-1964 period was characterized by strict wage control. The government exercised this control until 1974 (the year to which our most recent data refers), by setting indices of monthly wage readjustments applicable in the (also monthly) collective wage agreements. These indices, should theoretically compensate for increases recorded in the cost of living, corrected by increase forecast for the next period, and, in addition, incorporate the increases in productivity obtained during the previous period.

Since the formula for the calculation of the readjustment indices for collective agreements was identical to that used for the calculation of the index of minimum wage readjustment, [72] and knowing that the minimum wage was substantially reduced in real terms, [73] one would expect this reduction to have also affected industrial wages. Current literature on this issue is quite controversial. Critical authors of the Brazilian economic model in its distributive aspect state that wage policy has systematically reduced the real value of wages of economic activities in general. Some even state that the function of the minimum wage was precisely that of imposing a single wage rate on the economy, in order to prevent certain categories from being remunerated at a much higher rate than others. [74]

In opposition to the government's critics are those who defend the official viewpoint, that is, although the minimum wage has suffered a reduction in purchasing power, this result is of little importance to industry. To support this thesis, they put forth the following arguments: a) "the data of the PNAD [75] also indicate that the percentage of people earning minimum wage has decreased since

72 As would be expected, the indices of readjustments of collective bargaining of the month of readjustment of the minimum wage were identical to the indices of readjustments of the latter.

73 See, for example, Lívio W. R. de Carvalho, *op. cit.*, and the works of Maria da Conceição Tavares and Albert Fishlow in this area.

74 See, for example, Francisco de Oliveira, *op. cit.* Defending a similar point of view, the recent work of Paulo Renato Souza and Paulo Eduardo Baltar, *op. cit.*, adds new and valuable information in this respect; by the way, this brief summary of the present status of literature on wage trends is based on that work.

75 Pesquisa Nacional de Amostra por Domicílio: National Survey of Household Samples.

the period (1970 to 1973";[76] b) wages in the labor market are determined by the demand and supply of labor, independently of official policy;[77] c) real wages in industry have increased considerably in real terms throughout the past several decades, based on statistics on average industrial wages.[78]

We must also recall the studies which sought to identify the distribution of the increases in average wages and which discovered that the beneficiaries were few in number, thus suggesting a persistent increase in the degrees of dispersion.[79]

In this subsection, we attempt to study the trend of wages and of wage structure for the period 1970 to 1974, characterized according to the previously described methodology (subsection 3.2). We shall compare the trend in average wages by wage groups with the trend of the minimum wage.

Graph 1 indicates that, during the period 1970 to 1974, there was a considerable increase, in current values, of the total average wage of the manufacturing industry (the TAW curve), *vis-à-vis* increases in the minimum wage.[80] Utilizing the cost of living index in São Paulo (calculated by the Inter-Union Department of Statistics and Socio-Economic Studies (DIEESE) as the deflator of the minimum wage, the latter decreased progressively in real terms during the period: from Cr$ 183.88 in April 1970 to Cr$ 141.77 in April 1974, at 1970 prices. Utilizing the same deflator for the total average wage, the latter rose in real terms by 4.2% during the period: from Cr$ 360.54 in April 1970 to Cr$ 375.78 in April 1974, at 1970 prices.

76 A. Delfim Netto, "As Classes Baixas Têm de Agir para Ganhar", in *Jornal do Brasil* (October 22, 1978), p. 39, cited by Paulo Renato Souza and Paulo Eduardo Baltar, *op. cit.*, p. 634.

77 R. Macedo and M. E. Garcia, "Observações sobre a Política Brasileira de Salário Mínimo" (São Paulo: FIPE/USP, 1978), mimeo., p. 18.

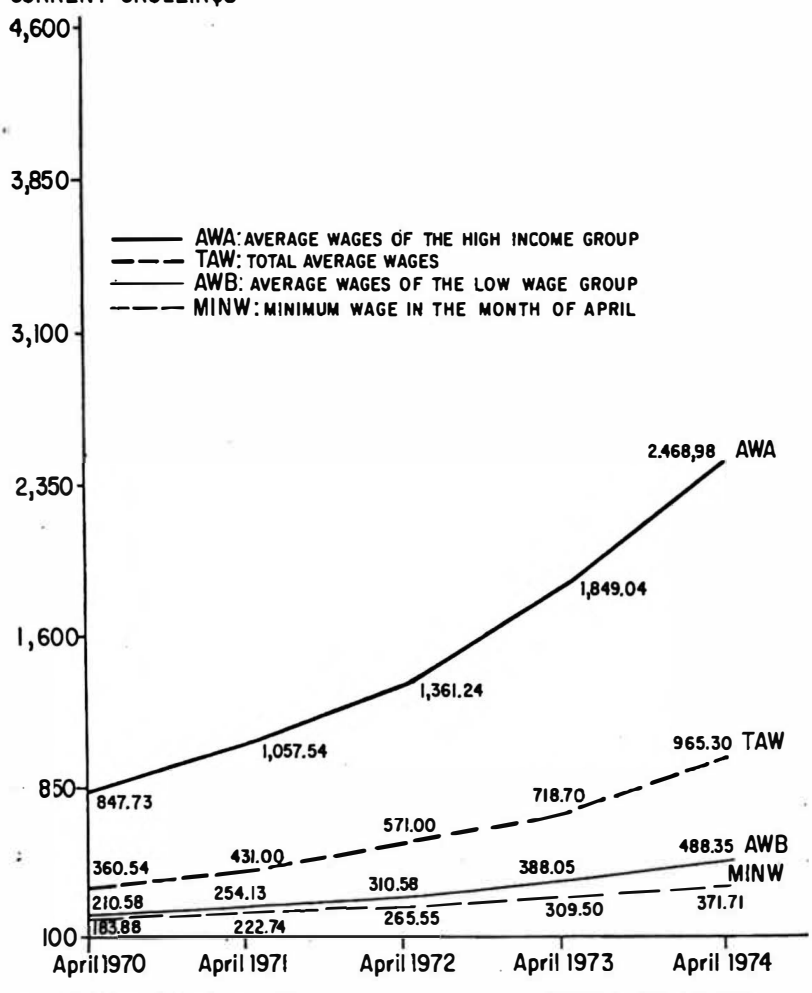
78 As, for example, the recent (May 31, 1979) statements of the former Minister of Planning, M. H. Simonsen, in the National Congress, based on work developed by Carlos von Doellinger, "Salário e Política Salarial", in *Revista de Finanças Públicas*, no. 339 (July, 1979), pp. 9-19.

79 See, for example, Edmar L. Bacha, *op. cit.*

80 Note that all the values in cruzeiros were maintained in current values, and not in real terms. As the data from the Law of the 2/3 are for April of each year, and those of the minimum wage are from May to May, we took a projection of the minimum wage month to month, based on the rate of growth from May to May, and utilized the minimum wage projected for April. There is little difference between the absolute values, since the difference is only one month and the annual variations for one or the other criterion are practically identical.

Graph 1

TOTAL MANUFACTURING INDUSTRY: MINIMUM WAGE TREND, TOTAL AVERAGE WAGES AND LOW AND HIGH WAGE GROUPS (IN CURRENT CRUZEIROS) APRIL 1970 TO APRIL 1974



SOURCES: Tables 2 and 8.

Note, however, that the increases in total average wages were fundamentally influenced by the increases in the average wage of workers in the internal labor market (AWA curve). This represents an average of 24% of the labor force for the period. The remaining 76%, including the workers of the external labor market, received increases nearly identical to those of the minimum wage. As a result, the workers of the external labor market (Group B) who, in 1970, received an average of the equivalent of 1.15 minimum wages, in 1974 received 1.31 minimum wages, whereas the workers of the internal labor market (Group A) increased this relation from 4.61 to 6.64 minimum wages. This represented an increase in the wage dispersion between these internal and external segments from 4.03 in 1970 to 5.06 in 1974.

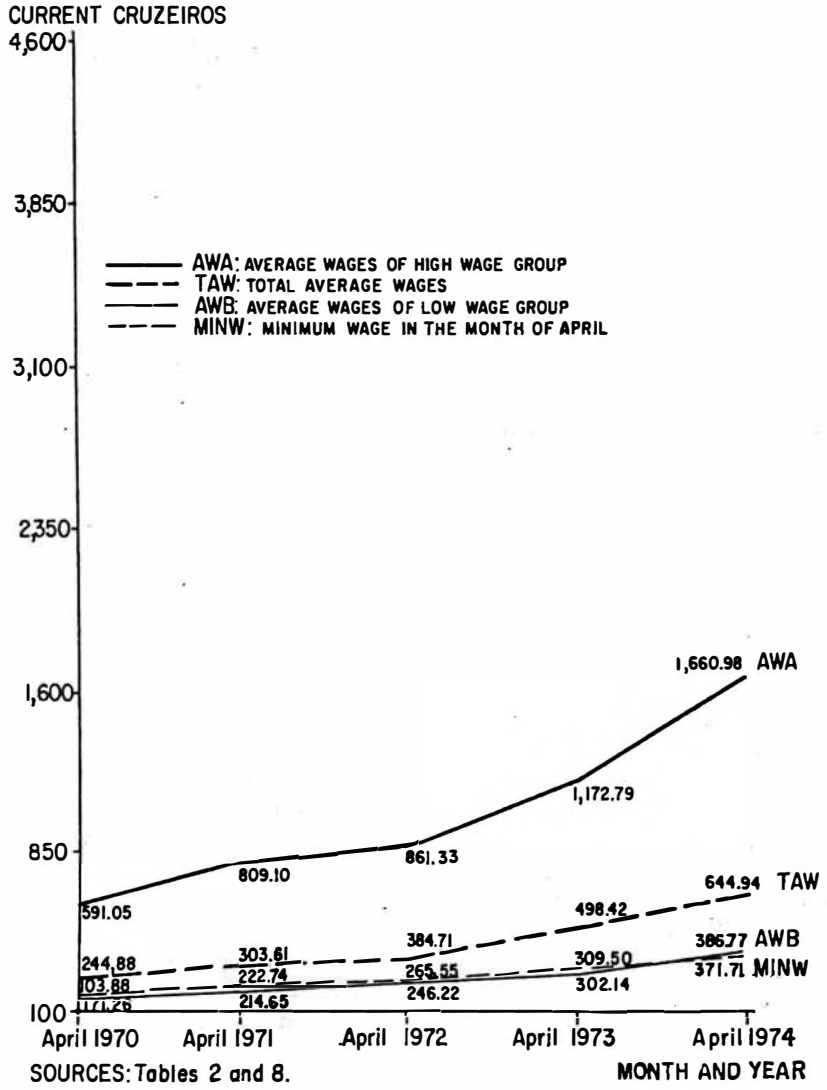
The results on total average wages seem to confirm the official hypothesis concerning the industrial wage trend, however when the labor market is considered as segmented into internal and external markets, the results indicate that wage increases primarily benefitted the workers in the internal labor market. The workers of the external labor market, who constitute approximately 3/4 of the labor force, had their wages readjusted by decree, with the minimum wage serving in effect as the wage rate in the manufacturing industry.

The results of the wage trend by industry branch qualify this information. In the branches Non-Metallic Minerals, Wood, Furniture, Leather and Hides, Plastics, Textiles, Clothing and Footwear, Food Products and Miscellaneous, the average wages of the external labor market (AWB) are, year after year, lower than the average wages in the external labor market of the total manufacturing industry (the AWB of these branches is, each year, lower than the AWB of the total manufacturing industry). The average wages paid in these branches approximate the minimum wage level; in other words, they display a trend parallel to that of the minimum wage, as can be seen in Tables 7 and 8 and Graph 2 (as in the case of Food Products).

It should be emphasized that these are the "traditional" sectors which, as seen in Subsection 3.3.2, show lower indices of concentration of production, a smaller capital/labor ratio, lower profit margins, lower average productivity and lower growth rates during the period. Wage readjustments below the increases in the cost of living can more easily be imposed on these industrial sectors, since their workers, situated in the external labor market (representing 54% of the workers of the external labor market of the total of the industry during the period), are less organized and not in a position

Graph 2

FOOD PRODUCTS, REPRESENTATIVE OF THE TRADITIONAL SECTORS: MINIMUM WAGE TREND, TOTAL AVERAGE WAGES AND HIGH AND LOW WAGE GROUPS (IN CURRENT CRUZEIROS) APRIL 1970 TO APRIL 1974



SOURCES: Tables 2 and 8.

to make greater demands. The minimum wage policy during the period represented this type of readjustment.

On the other hand, in the Metallurgy, Mechanics, Electrical Machinery and Parts, Vehicle Construction and Repair, Paper and Cardboard, Rubber Goods, Chemicals and Pharmaceuticals, Cosmetics, Soaps and Candles, Beverages, Tobacco and Printing and Publishing sectors (in which the average wages of workers of the external labor market are, year to year, equal to/or above the average wage of the same group in the total industry) there was a divergent wage trend in relation to that of the minimum wage, as can be seen in Tables 7 and 8 and in Graph 3 (case of Vehicles Construction and Repair). As previously mentioned, these industries have relations of structure and performance inverse to those of the first group.

Curiously, and as can be observed in Tables 7 and 8, the readjustments indices for the average of workers of the external labor market are quite similar to the variations in the cost of living in São Paulo, as calculated by the DIEESE. This suggests that, in a certain manner, the workers in these industrial sectors, who certainly are better organized, succeeded in that period in imposing their own indices of monetary readjustments.

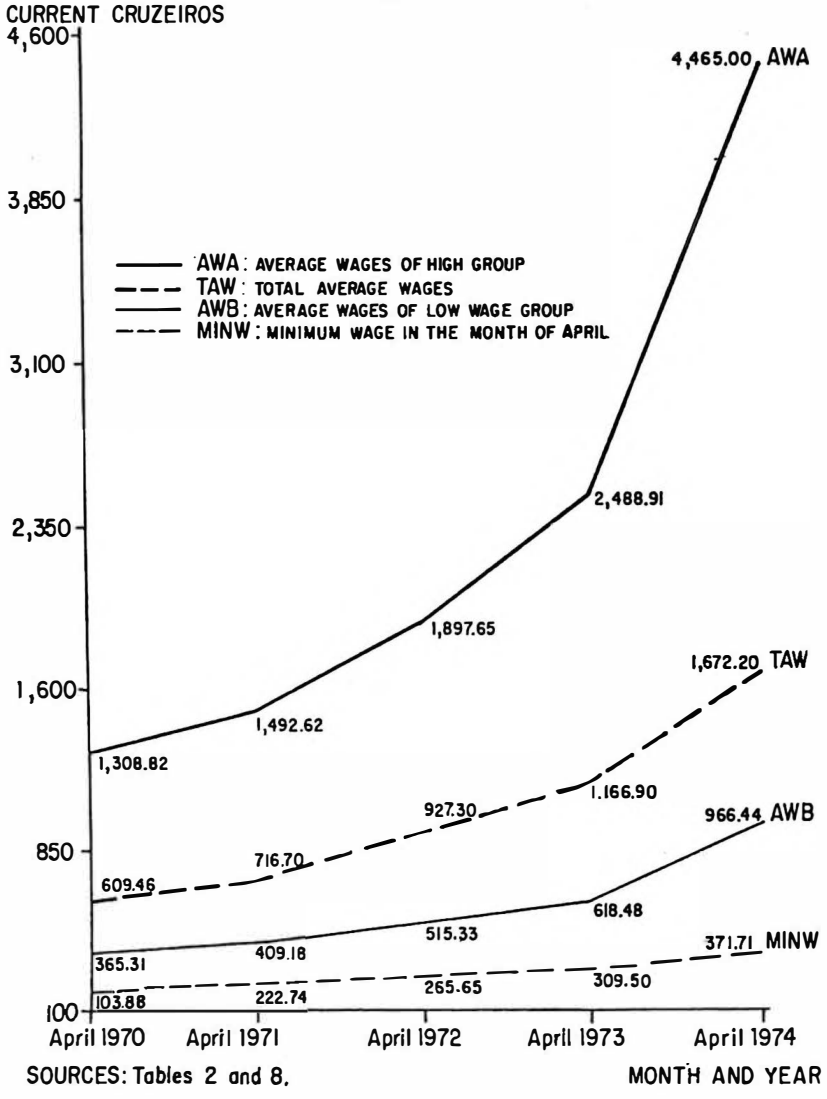
The same tables and graphs also indicate that the largest increases in the average wages or workers of the internal labor market (AWA) occur in this second group of industrial sectors, which are sufficient to widen the wage dispersion (AWA) of these industries in 1974 by an average of 36% (approximately 5.06), which already was quite high in 1970 (approximately 3.71). In the first group of industries, the increase in the average wages of the more highly paid group, while less generous, was sufficient to widen the wage dispersion by approximately 21% (from 3.48 in 1970 to 4.22 in 1975).

Therefore, in the more dynamic branches the wages of the more highly remunerated group of workers increased by a larger proportion than they did for the corresponding group in the less dynamic branches. During the period 1970 to 1974, the real average in the high wage group in the Vehicle Construction and Repair branch increased by approximately 30%, and only by 7% in the Food Products branch. [81]

81 We utilized the cost of living index for the city of São Paulo as a deflator (Table 8). Is should be kept in mind, however, that the prices of the most important consumer goods in the wages of this group of workers increased less during the period thant the prices of the most important consumer goods in the wages of the low wage group of workers. If this aspect was considered, the increase in real wages of the high wage group becomes even greater.

Graph 3

VEHICLE MANUFATURE AND REPAIR, REPRESENTATIVE OF THE DYNAMIC SECTORS: MINIMUM WAGE TREND, TOTAL AVERAGE WAGES AND HIGH AND LOW WAGE GROUPS (IN CURRENT CRUZEIROS)
APRIL 1970 TO APRIL 1974



SOURCES: Tables 2 and 8.

4 — Summary and conclusions

The broader objective of this paper was to empirically examine current hypothesis on the movements of reconcentration of income in Brazil in the post-1964 period. There were two such movements: the first was the increase in the share of profits and the consequent decrease in the wage share; the second was the redistribution of part of the share of the increased profits to several categories of wage-earners, which in effect constituted a redistribution of wages.

The study focused on the manufacturing industry, disaggregated by branches (two digits) and was divided into two major parts; in the first, we attempted to characterize the profit-wage distribution, relating it to its technical and social determinants, and, next, to measure the magnitude of the increased level of profits. The principal conclusions were:

a) The magnitudes of the profit share are explained by the degree of monopoly of the industry and by the greater relative share of capital *vis-à-vis* labor in the productive process.

b) During the period 1959 to 1974, there was a considerable increase in the profit share (+ 24.4%) due to the policy of increasing the value of capital, and was substantially supported by the wage limitations policy imposed on the lower income groups.

In the second part of the study, we sought to characterize the segmentation of the labor force and the wage structure according to their technical and social determinants and, next, to examine the trend in the two wage categories defined. The most important conclusions were:

a) The magnitude of the internal labor force (proportion of workers who receive high wages) in each category depends fundamentally on the degree of concentration for two complementary reasons: first, industries with high degrees of concentration (power of monopoly) generate greater surpluses, encouraging workers to negotiate more aggressively for its distribution; and second, and for this reason, these industries require broader mechanisms of control and cooperation of the labor force.

b) The result of these two forces is manifested in the wage levels of both categories, although more strongly in the more concentrated industries. This indicates that, although less favored, the positions of external labor benefited from the higher income produced by the market position of the more concentrated industries.

Within these industries, the average wage of the external labor force rose to slightly above the minimum, practically parallel to the cost of living index as calculated by the DIEESE, making it appear that these workers were able to maintain their real wage.

c) In the less concentrated industries and industries with poorer performance, the average wage of the external labor market kept pace with the trend of the minimum wage which, in effect, functioned as a base-wage for these industries. The loss in real value was therefore transmitted to this class of workers who, for this period, represent an average of 41% of the labor force employed in the manufacturing industry.

d) The same behavior was observed in the trend of the average wage of workers of the internal labor force, according to the industries degree of concentration. In this case, however, the increases in the average wage of the internal labor force for the more concentrated industries and those having greater profit margins were much sharper, causing an average increase of 36% in the dispersion between average wages, whereas in the less concentrated industries and those having lower profit margins, this increase was 21%.

Determinants of Brazilian industrial performance: an econometric study *

Helson C. Braga **

1 — Introduction

Analysis of Brazilian industrial performance has become a popular theme in a broad range of literature on the country's recent industrialization proces. [1] These analysis have generally looked at sectoral growth rates which allegedly result from economic policy measures — whether specifically aimed at stimulating industry or not — and at the differential evolution of these rates by industrial sector. The growth rates are used to classify the industries as *traditional* or *dynamic,* categories that, along with others such as consumer goods or producers' goods industries, are used to analyse structural changes in employment, wages, productivity and value added.

A different approach is to be found in the doctoral theses of Langoni (1974) and Novaes (1975), which calculate the private and social rates of return to capital by industrial sector. Langoni associated high rates of return to physical capital with *modern* industries and/or monopoly situations, and low rates of return with *traditional* and/or highly competitive industries. The modern sector's high rates were interpreted, assuming competition, as a short-term

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1 See, especially, Suzigan *et alii* (1974); Baer (1966); Tyler (1976); Candal *et alii* (1969); Malan *et alii* (1977, chap. 5).

disequilibrium in which highly skilled businesmen take advantage of new profitable opportunities while investment — due to imperfect information — are not growing fast enough to bring rates of return back to their normal level. [2]

In Novaes' view, low rates of return to foreign capital are basically a result of price controls, while high rates are associated with the presence of monopolies, export incentives and the accelerated growth of demand due to government programs and to the process of industrial growth itself. [3]

These approaches indicate two problems inherent in the analysis of industrial performance. First, performance criteria or dimensions must be defined. Second, the analysis must be based on a methodology that can explain inter-firm performance differentials and still be compatible with the criteria adopted.

This article's objective is precisely to develop an analytical framework that can explain performance differentials in Brazilian industry as measured by private profitability, both at the level of industrial sectors and at the level of private firms. It is an amplified version of the basic model of industrial organization, adapted to the conditions of a developing economy and incorporating certain institutional characteristics of the Brazilian economy, as well as certain effects of recent economic policy.

At a sectoral level, the study is based on three levels of aggregation: the two-and four-digit classifications of the Federal Revenue Department (SRF) and the classification used by Editora Visão in its publication *Quem é quem na economia brasileira,* which is an intermediate classification between the first two. [4] Most of the data on industries were taken from publications of these two institutions.

For the analysis of individual firms, the main data source was a stratified sampling of 549 industrial companies, randomly selected from the *Cadastro do imposto de renda de pessoa juridica,* for the 1973-75 period. [5]

2 See Langoni (1974, pp. 33-5).

3 See Novaes (1975, pp. 112-5).

4 For a detailed discussion of the adequacy and significance of these levels of aggregation for this type of study, see Braga (1980, pp. 37-41).

5 Information used in the study was taken from income tax returns in the SRF. A number was assigned to each firm, and all data associated with that number.

2 — Determinants of performance at the industry level

2.1 — Analytical structure

The traditional model of industrial organization is part of a general methodology for economic market analysis based on static price theory and working with three basic concepts: a) market structure; b) individual firm behavior patterns; and c) economic performance.

Market structure refers to those characteristics of market organization determining the nature of competition and price setting — characteristics that are relatively stable in the short run. Behavior patterns are the manner by which firms adapt or adjust to their markets, and include price and output decisions as well as other modes of non-price competition — such as strategies for sales promotion, research and innovation, and the degree to which the firms cooperate, formally or informally, in the determination of these policies. Behavior patterns are frequently defined more strictly in terms of price competition. Performance includes the industry's economic results in terms of technical and allocative efficiencies, technological progress, employment and equity. [6]

The three concepts are intrinsically inter-related, in that performance which can be explained by the behavior of firms, which in turn is determined by market organization or structure. The latter reflects basic supply and demand conditions. [7] Chart 1 summarizes these relations and the content of each concept.

There are cases, however, where the direction of causality can be inverted (broken lines in Chart 1). Research and development investments, for example, can change the industry's technology and thereby the product's cost and/or differentiation conditions. Cartel agreements can also raise entry barriers, with long-term effects on the industry's structure. Yet many authors suggest that the direction of causality flows mainly from structure to behavior. [8]

There is, however, a more serious problem regarding behavior that affects the consistency of the model itself. In the highly abstract world of perfect competition and pure monopoly, the assumption of profit maximizing behavior ensures a direct line of causality from

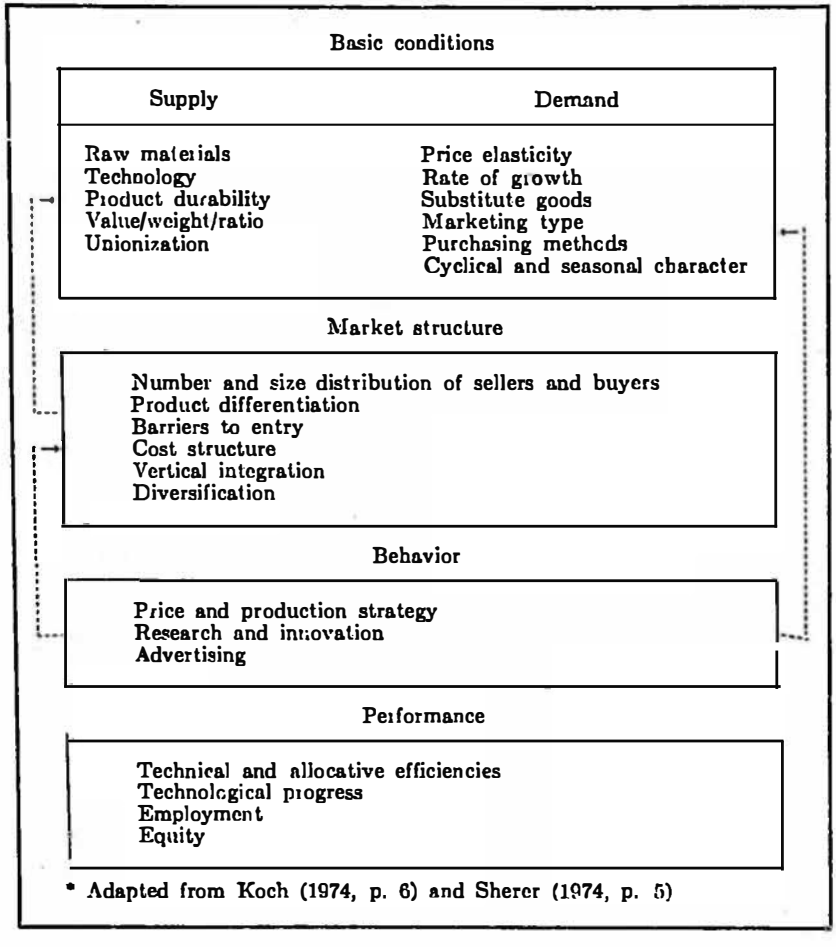
6 These concepts are based on Bain (1968, pp. 7, 9 and 12).

7 Koch (1974, pp. 3-10); Sherer (1974, pp. 3-7).

8 See, for example, Mason (1939, p. 198); Cameron (1975, p. 303) and Grether (1970, p. 85).

Chart 1

Structure of Traditional Model for Analysis of Industrial Organization *



* Adapted from Koch (1974, p. 6) and Sherer (1974, p. 5)

structure (number of firms) to behavior (price-setting and output levels) and performance (marginal price/cost ratio). In either case the businesman seeking to maximize profits can only choose the output level determined by the equalization of marginal cost with marginal revenue. Structure thus directly determines performance

and the consistency of the model holds intact. In intermediate cases, however, behavior is not determined by structure alone, even assuming profit maximization.

Indeed, what distinguishes imperfect competition is the fact that, given the interdependence among firms, other complementary hypothesis besides that of profit maximization (or any other alternative hypothesis of individual firm motivation) are required to determine an equilibrium price/output combination.[9] And, depending on these additional hypothesis, several performance patterns will be consistent with a single market structure (specially those with a small number of firms). Since virtually all markets in the real world fall into this broad category, we would expect imperfect competition models including the complementary hypothesis to be more useful in empirical research. Unfortunately, there is no behavioral explanation generally accepted by the several existing theories.[10]

As a result, Bain, in the first empirical study of its kind, focused on the structure/performance relationship, omitting behavior.[11] The reasons for his simplified formulation were:[12]

1. The inclusion of behavior variables is not essential to the development of an operational theory of industrial organization, since acceptable performance forescasts can be obtained simply by using structural measures as independent variables.

2. A theory based on the structure/behavior/performance relationship generates ambiguous forecasts, since highly divergent types of behavior may be produced by a given set of structural conditions. In addition, supposedly similar behavior patterns can produce various types of performance.

3. Even if a satisfactory structure/behavior/performance hypothesis could be formulated, it would be very difficult to test, considering that: a) much published information on business behavior is incomplete or unreliable; b) firms normally restrict access by researchers to their internal information; and c) even if this difficulty were overcome, research on firms' decision-making processes would be so costly and time-consuming that few studies

[9] In the two extreme cases of competition, only the assumption of profit maximization is necessary. Cf. Vernon (1972, pp. 12-5).

[10] Koch (1974, p. 268. See the survey of these theories in chapter 13).

[11] Bain (1951). Actually, Bain focused on only one structural dimension the degree of concentration — among the three he considered most important, the other two being entry conditions and the degree of product differentiation.

[12] Bain (1968, chapters 9 and 10).

could be carried out, a situation which could lead to generalizations on the basis of inadequate samplings of special cases.

In addition, "if we analyse the model's three basic concepts in detail, were see that they have predicted first certain relationships of structure to conduct, and then certain relationships of conduct to performance. And in so doing, these hypothesis have also predicted certain direct relationships of market structure to market performance – the "link" of market conduct being implicitly subsumed". [13] Indeed, one of the model's basic predictions is that the higher the degree of concentration in an industry (one element of market structure), the higher the probability of formal or tacit collusion among the firms (a behavioral pattern) to adopt policies for joint profit maximization.

Given the precedent set by Bain, behavior has not received explicit attention in empirical studies on industrial organization. Nonetheless, as we shall see, behavioral considerations are always present in attempts to racionalize the extension of the basic model.

We can now review the model's theoretical basis, identifying its basic predictions regarding the influence of the main dimensions of market structure on economic performance, as measured by private profitability.

While long list of such dimensions have been proposed, [14] there is general agremement in limiting the number to the three suggested by Bain: a) degree of concentration; b) level of barriers to entry; and c) extent of product differentiation.

Bain posits that definitions including all the significant characteristics affecting the behavior of firms in a given market (psychological, technological, geographical or institutional) would tend to make each market structurally unique, marking it difficult to compare markets and generalize as to the influence of structure on behavior. [15]

2.1.1 – Concentration and performance

Economic theory uses the concept of concentration (distribution of the number and relative size of firms) to differentiate industries into three categories: a) atomistic; b) oligopolistic; or c) monopolistic.

[13] Bain (1968, p. 430).

[14] Vernon (1972, pp. 28-9) proposed 12 dimensions, and McKie proposed 20 (1972, pp. 9-10).

[15] The main reference for the following discussion is Bain (1968, chapters 2, 5, 7, 8, 9 and 11).

In the first category, as a result of the relatively small size and large number of firms (which reduces the possibility for collusion), the industry's output will grow (and prices drop) until marginal cost equals price. In long-term equilibrium within this category, profits will not exceed *normal* profits (which can be approximated by the interest rates resulting from the proprietors' application of capital).

In the monopoly situation, the single seller can choose the price that maximizes profit (or, more generally, the utility-function of the managers) by raising or lowering the level of output. The monopolist will generally produce less and charge more than in a competitive industry under similar cost and demand conditions, thus earning *higher than normal* profits.

An oligopoly — with a few major sellers — as in an atomistic market, displays a typical rivalry among the firms. Yet the relative size of each allows any change in position of a single firm to effect noticeable changes on the other firms' prices and sales volumes, thus increasing the complexity of price-output decisions by the need to anticipate the competitors' reactions. Once they have recognized their interdependence, the small group of firms may well find it practical to establish market controls in order to seek maximization of the industry's overall profits. Any firm's disrespect for the agreement, since it will affect the others, will provoke retaliation — thus operating as a stabilizing factor for the general arrangement.

It is easy to see, though, that there are degrees of interdependence and collusion, and a broad range of degrees and forms for each. There are several possible patterns for collusion, ranging from complete collusion (the firms acting jointly as a monopoly) to total independence, where price and output decisions are taken unilaterally, requiring a larger number of competitors. It is significant that, even without explicit collusion, a high degree of interdependence among the firms could force the adoption of price and production policies with results similar to those of formal collusion. This would be a case of tacit collusion.

The theory suggests that interdependence among the firms is determined by the industry's degree of concentration.[16] Thus two inter-related propositions arise:

a) *ceteris paribus,* oligopolistic interdependence grows with concentration and weakens as concentration diminishes; therefore;

[16] In fact, the influence of the number of firms on the interdependence among them can be demonstrated by a simple arithmetic exercise, observing, for example, the decreasing effect of a given price reduction by one firm on the sales of the others, as the number of firms increases.

b) the greater the degree of oligopolistic concentration, the greater the probability of joint adoption of a monopolistic price/volume arrangement. Inversely, the lesser the degree of oligopolistic concentration, the greater the probability of rivarly among the firms and, therefore, of movement away from joint maximization of profits in the direction of price and output decision-making patterns typical of an atomistic industry.

Empirically speaking, instead of simply distinguishing oligopolistic and atomistic industries, the traditional model would distinguish among several sub-categories of oligopolistic industries based on their degree of concentration. We should thus expect the behavior and performance of each sub-category to vary with the level of concentration and the corresponding degree of oligopolistic interdependence.

Strictly in terms of performance, the theoretical implication is that, in the long run, there will be a tendency for high levels of concentration to be associated with high degree of profitability (monopoly profits) and, inversely, for lower degrees of concentration to be tied to lower profit rates; the profit differences should thus reflect the excess of price over average cost corresponding to the various levels of monopoly restriction of output. [17]

In Connor's (1977) view, the following reasons would lead one to expect a weak relation between concentration and profitability in a developing country:

a) cultural differences between the leaders of local and multinational firms which might make collusion difficult;

b) high transportation costs which could introduce distortions in concentration ratios calculated on a nation-wide basis, especially in large countries;

c) high industrial growth rates in recent decades, which might diminish the degree of concentration;

d) most of the countries in question have relatively *open* economies, which could reduce the impact of domestic concentration on profitability. [18]

[17] One hypothesis implicit in this formulation is that the elasticities of demand for all industries are approximately equal. Indeed monopoly's maximization of profits leads directly to $\frac{P - AC}{P} = \frac{1}{\eta}$ (where η is the price elasticity of demand, P is price and AC is the average cost). It thus follows that one monopolist would show greater profitability rate than another simply due to a smaller η in his market.

[18] Connor (1977, p. 152).

While Connor, is correct in principle, in suggesting possible differences in the behavior of the profitability to concentration ratio in the context of a developing economy, his observations do call for some comment. While the first point may be valid in terms of collusion between local and foreign firms, it could hardly be applied to the latter alone.[19] And the most concentrated industries tend to be precisely those dominated by multinational and state-owned firms.[20] Observations *a* and *d* can be dealt with by introducing corrections in the indices used to measure concentration, such as geographical dispersion and foreign competition (see Appendix). As for observation *c*, it is a generalization of a hypothesis raised by Gale (1972) that still remains to be proved empirically (see item 3.1).

2.1.2 — *Entry barriers and performance*

A high degree of concentration is a necessary, but not a sufficient, condition for continued high rates of profitability. Market power cannot, ideed, be maintained in the long run if it is not protected by entry barriers. According to Bain, these barriers consist of advantages enjoyed by firms in the industry over those which could potentially enter the market.[21]

An extremely useful concept in analyzing this relationship is that of limit price, developed independently by Bain (1962) and Sylos-Labini (1962) and defined as the highest price that existing firms could charge in the long run without attracting new competitors.[22] They argue that the limit price and the monopoly price may coincide where there are very high barriers, and that where barriers are lower the limit price will be set below the monopoly price and will tend towards the competitive price as barriers decline. The expectation in thus that this behavior will only be reflected significantly in firms' performance in oligopoly situations where concentration is high enough to allow effective market control.

19 For a detailed discussion on the nature of competition among multinationals in developing countries, see Fajnzylber (1976).

20 See Connor (1977, pp. 86-116), on the Brazilian and Mexican cases.

21 Stigler (1976, chap. 6) presents a different interpretation: an entry barrier is the cost of producing at any production level which must be faced by a firm wanting to enter the industry, but which is not faced by the existing firms. Thus two types of barriers mentioned by Bain — economies of scale and required capital — would be taken by Stigler simply as determinants of firm size. The argument is that existing firms face exactly the same general conditions regarding these limitations. In a typically imperfect capital market situation, Bain's concept seems more appropriate.

22 For a good summary of these theories, see Modigliani (1958).

There is thus interaction between the two structural dimensions in determining behavior and performance.

2.1.3 — Product differentiation and performance

The degree of product differentiation refers to the extent to which consumers differentiate or have specific preferences among the products of the various firms making up the industry. In these terms, price theory classifies industries as:

a) homogeneous;

b) having differentiated products. This classification applies both to oligopolistic and atomistic industries. [23]

The basic implication of product differentiation in terms of this study's objectives is that it broadens the sales and behavior policy options open to the firms. It not only affects the nature of competition among established firms, but also raises the level of entry barriers. Indeed, the ability of a few firms in a single industry to guarantee substantial advantages over the rest in terms of product differentiation has often been the basic reason for maintaining oligopolistic structures. [24]

Where product differentiation is possible, we would generally expect the firms to perceive an incentive to:

a) invest in advertising and other promotional expenditures to expand demand for their product; and

b) vary the product's packaging and quality in order to achieve the most profitable combination of production costs and market conditions. As a result, the will be able to charge higher prices than their competitors as they win consumer loyalty and thus exert a certain amount of market power.

Price theory sheds no clear light on the influence of product differentiation on profitability, aside from assertions such as "there

23 Technically, the degree to which consumers consider different products to be interchangeables is given by the cross-elasticity of demand, which, for this reason, provides a theoretical criterion for setting the frontiers of an industry. Elasticity will be high (tending towards infinity) among products of the same industry and very low (tending towards zero) among products of different industries. Obviously, the degree of interchangeability must be corrected to include differences of localization implying significant transportation costs.

24 Bain (1968, p. 231).

will be some sales-promotion costs, which raise the total cost and probably the price of supplying goods by some amount".[25]

Despite the weak theoretical basis, some empirical studies have allowed for a positive correlation (subject nevertheless to conflicting interpretations, as we shall see) between intensity of product differentiation and profitability.[26] In addition, in the sphere of economic policy making, the possible positive relationship between product differentiation and market power has produced proposals in the USA to impose limits on advertising expenditures.[27]

Theoretical predictions of the influence of the major dimensions of market[28] structure on profitability can be analytically summarized as follows:

$$\pi = \pi\ (CR,\ BE,\ DP) \qquad (1)$$

where,

π = profit rate;
CR = concentration ratio;
BE barriers to entry;
DP = degree of product differentiation.

The prediction is that the signs of the partial derivatives will all be positive:

$$\partial\ \pi/\partial CR > 0,\ \partial\ \pi/\partial BE > 0 \quad e \quad \partial\ \pi/\partial DP > 0 \qquad (1a)$$

Besides these structural variables, which are the core and principal theoretical basis of the model to be used in this study, we will include a number of other variables suggested by recent studies and of sufficient theoretical consistency. These variables will be used to:

a) achieve a better approximation of the economic significance of the measures used to represent structural variables (for example, foreign competition and geographical dispersion of industries, in relation to levels of concentration);

25 Bain (1958, p. 30).

26 US Government, Federal Trade Commision (1969); Miller (1969); and Comanor and Wilson (1971).

27 US Government, President's Committee on Price Stability (1969, p. 82); Turner (1966, p. 10); and Markham (1967).

28 While Bain also considers a fourth dimension (the degree of consumer concentration, meaning the number and size distribution of consumers), it has been omitted, for obvious statistical reasons, from all empirical studies, with the exception of the studies by Lustgarten (1975), Porter (1974) and Guth, Schwartz and Whitcomb (1977).

b) identify the influence of the institutional context and of economic policies (such as the origin of the firms' capital or the nature of fiscal incentives); or

c) merely isolate the precise influence of the essential structural variables on which the model is based (as in the case of growth of demand or of capital intensity).

Before proceeding to the development of the basic model, however, we should discuss some criticisms of its theoretical implications.

First of all, a number of authors, while agreeing with the model's basic forecast — a positive relationship between concentration and profitabiltiy — have preferred to emphasize other types of relations. Demsetz (1973a, 1973b and 1974) suggests that concentration and high profit rates arise in a competitive setting due to the expansion of firms able to reduce costs or to discover better means of serving their clientele. Market power resulting from this expansion would come from competitive superiority; and the destruction of this market power through anti-trust measures would reduce the economy's efficiency, whether by penalizing successful innovators or by limiting production to small, high-cost firms. [20] In a recent study, Peltzman (1977) seeks to divide the concentration-profitability relationship into two others: concentration-price and concentration-cost, since "any profitability measure implies a corresponding difference between price and average cost..." and "the causal relationship running from concentration to profitability can operate either through an effect on price (the usual interpretation) or on average cost, or, of course, both." The main conclusion is that, "while the price effect is not absent, the cost effect is sufficiently strong to shed doubt on the efficacy of rules hostile to industrial concentration." In general, these criticisms do not mean rejection of traditional theory, but merely a concern that among the policy measures it suggests there may be prejudicial effects on economic efficiency.

Another line criticizes the use of high concentration ratios as proxies for the existence of explicit or tacit collusion. The positive relationship between concentration and profitability is attributed to reasons other than possible collusive arrangements. Ornstein (1972) presents a two-stage argument. First, the traditional model assumes that the cost of collusion decreases as the number of participants falls, due to diminishing difficulties of negotiation, coordination and enforcement. However, the model neglects several

[20] See also McGee (1971), Brozen (1970, pp. 279-92) and Singer (1970, pp. 92-3).

factors, such as the degree of product heterogeneity, varying cost structures, the potential entry of new competitors and a return to breaches of the agreement, all of which would contribute to the instability of the collusive arrangement. Without a complete oligopoly theory, therefore, it would be quite daring to hypothesize a simple relationship between the two variables alone. Secondly, finding no independent effect of concentration on profitability, Ornstein interpreted the result as the absence of collusion effects. Concentration would be related to entry barriers which, along with changes in the firm's and industry's demand, he associates with profitability. Therefore it is the entry barriers, and not concentration, that should be the main focus of public action.[30] Yet the weakening of a variable's exploratory power due to high colinearity with other independent variables (as is generally the case with measures of concentration and of entry barriers) is a common occurrence in this kind of econometric exercises.

Asch and Seneca (1976) tried to examine directly the collusion effect on the profitability of a group of American industrial firms, broken down into collusive and non-collusive. The result was the discovery of a negative relation between collusion and profitability. Two main explanations were offered:

a) weak performance induces a firm to collude; and

b) anti-trust controls concentrate on unsuccessful cases; in other words, cartels with weaker performances are easier to identify. The authors consider this to be the more plausible explanation, and that the relation found merely reflects an enforcement bias.[31]

A third criticism is offered by Grether (1970) and by Grabowsky and Mueller (1970), and relates to the possible inability of the model to handle large and diversified firms. Their reasoning is that the model's underlying price theory applies to single-product firms and therefore has little to offer in the line of testable hypothesis dealing with the behavior of a conglomerate operating with several products, production lines and geographical divisions. The model would have to incorporate not only these firms' internal coordination aspects, but also the forms of interaction between their organizational policies and market structure. While there is a clear need for more

[30] Ornstein (1972, p. 520). The only attempt to theoretically correlate concentration and collusion was done by Stigler (1976, chap. 5), exploring conditions which would favor enforcement.

[31] The colluding firms were selected from among those tried for violation of the Sherman Act in the 1958-1967 period. Non-colluding firms were randomly selected from *Moody's Industrial Manual*.

detailed studies on market forms, the fact is that, as McKie (1970) stated, a large conglomerate presents a more complex empirical problem than a single-product firm, but is not essentially different.

In short, the traditional model reveals insufficiencies inherent to its broad generality (but it was precisely to deal with this level of problems that it was formulated), and there is an obvious need for it to be complemented with new theoretical developments. Yet, as Weiss (1974, p. 202) recalled in his second survey — covering more than 40 empirical studies on the relations between industrial structure and profitability in the USA, England, Canada and Japan — "the wide variety of profit or margin indexes, of concentration indexes, of other variables controlled for, of units of observation, of universes, and of data sources indicates that the relationship was quite robust." He suggests, in addition, that the business cycle people and the monetary-vs.-fiscal policy people would be delighted to see our kind of robustness in their articles."

We can now return to presentation of the complete model. First of all, it should be noted that the theory foresees the existence of rents associated with market power for given long-term demand and cost conditions. Indeed, high profit rates can be related to the expansion of demand or to the reduction of marginal cost over time, or to both. A study by Johnston (1960), which revealed strong evidence for constant medium-and long-term costs at various output levels in American industry, provided a convenient basis for excluding this variable in cross-section studies. Demand conditions have generally been incorporated into the model by means of an average rate of growth of output or of value added in an industry over a certain period of time. [82]

One rationalization of the relationship between rate of growth and profitability is the following: while the industry is growing rapidly, individual firms will probably feel less pressure from competition than in industries with moderate or stagnant growth rates and, therefore, will be able to raise prices and profits independent of the industrial structure. In addition, low growth rates or a decline in demand may lead to the breach of collusive agreements in industries with high fixed costs, due to the financial cost involved

[82] Obviously, the ideal measure would be the rate at which the demand curve moves over time. Under the hypothesis of constant long-term average costs, the rate of growth of output would thus be an equivalent measure. Without this hypothesis, however, the usual proxy could be reflecting changes either in demand or in the costs that produce movement along the demand curve. While these movements cannot be distinguished, they may be expected to have similar effects on profitability. Both a growth in demand and a reduction in costs would have a positive effect on profitability, unless they are perfectly antecipated.

in maintaining them.[33] This rationalization, which would suggest a positive correlation between the two variables, has received some empirical support.[34] On the other hand, an inverse relationship arises from a hypothesis raised by Caves, which posits that in an oligopolistic industry, rapid growth of demand may induce firms to behave competitively. Price cuts, even though reducing current profits, may be an attractive strategy for increasing market shares and, possibly, obtaining greater earnings in the future. Meanwhile, in industries with stagnant or declining demand, an individual firm's attempt to increase its market share would probably end up reducing the industry's total profits. Finally, more slowly growing industries tend to underestimate the value of their assets and net equity and, thus, simply for accounting reasons, to overestimate profitability due to the greater weight of older plants and equipment.[35]

Besides these conflicting effects on profitability, these considerations suggest that the effect of growth of demand depends in part on the industry's degree of concentration. The most propitious conditions for stable collusive agreements would be those offered by moderate growth. Both high and low rates of growth can negatively affect profitability in oligopolistic industries. Small firms (generally in atomistic industries), on the other hand, may show themselves to be flexible and adaptable to changes in demand conditions since they are unencumbered by the burocratized decision-making processes typical of large companies.

Despite Caves' argument for the opposite relationship, the hypothesis used in this article is that of a positive relationship between an industry's rate of growth and profitability, not only because of its greater theoretical consistency and favorable empirical evidence, but also because it better reflects the recent behavior of Brazilian industry.[36]

[33] Khalilzadeh-Shirazi (1974, pp. 69-70). See also Weiss (1963, p. 251).

[34] See, for example, Comanor and Wilson (1971, p. 431) and Esposito and Esposito (1971, p. 347).

[35] Caves (1972, pp. 30-1). Khalilzadeh-Shirazi (1974, p. 14) sought to test Caves' hypothesis, examining the differential effect of rate of growth on profitability in concentrated and non-concentrated industries. The coefficients found were positive, but statistically insignificant.

[36] Dynamic industries were more profitable in Langoni's (1974, p. 33) study, which defines dynamic industries in Shultz's sense (1964, chap. 2), that is that, besides growing rapidly, they show high productivity rates (output per unit of input).

With the inclusion of this variable, the traditional model as applied in most empirical studies — becomes:

$$\pi = \pi\ (CR,\ BE,\ DP,\ CD) \qquad (2)$$

where CD rate of growth of demand has a positive effects:

$$\partial\pi/\partial CD > 0 \qquad (2b)$$

It is clear, however, that the variables included in (2) adequately describe market structures only to the extent that the economy is not significantly affected by international factors. Yet in the case of a relatively open economy, it seems obvious that external factors affecting the competitive conditions of industries should be explicitly included. This will be done in the following section, with the discussion of:[37] a) foreign competition; b) export opportunities; and c) the participation of multinational companies.

2.1.4 — Foreign competition

Local firms in an open economy face both actual and potential foreign competition. It is therefore incorrect to infer that highly concentrated industries have correspondingly higher market power. High import levels in fact dilute the degree of domestic competition and reduce the firms' capacity to hold prices above long-term average costs. The theory also suggests that potential competition (the threat of entry of new domestic or foreign competitors) can force local producers to set prices closer to competitive levels. As Esposito and Esposito have demonstrated, potential foreign competitors exert a stronger influence on the pricing decisions of domestic firms — due to the greater ease with which they can overcome entry barriers — than do potential domestic competitors. In theory, therefore, one would expect lower profit rates in industries facing higher levels of actual and potential foreign competition.

The influence of foreign competition is obviously an inverse function of the tariff protection conceded to local industry. Yet inclusion of the relationship between foreign competition and profitability in our model runs into two types of problems. The first is that while higher barriers will raise the price limits set by domestic firms (implying a positive relation between the two variables), if the tariff's basic objective is protection, it will be precisely the least profitable industries that will require higher levies, indicating an inverse relationship.

[37] The basic methodology for this section is that used in Sorensen and Pagoulatos (1976a, 1976b)

The second problem is the possible interaction between the level of concentration (as a proxy for collusion) and the level of protective tariffs, which has complicated analysis where one of these variables is made dependent, due to the doubts as to the direction of causality.[38] In this article, while the second problem can easily be handled with the introduction of an interative term in the regression equation, the first could only be faced with an in-depth study of the history of tariff protection in Brazil. Since such a study would go far beyond the scope of this article, we have decided to use other, more direct, measures of foreign competition (see Appendix).

Despite Brazil's apparently high barriers (measured by nominal and effective tariffs), analysis should be expected to register some effect exerted by them on profitability, since, in more recent years, overvalued exchange rates may have more than made up for tariff protection in several industries.[39]

2.1.5 — Export opportunities

Khalilzadeh-Shirazi, the first to introduce exports as a variable in the model, suggested that they would tend to increase the industries' profitability as a result of the premium required for engaging in a high-risk adventure such as exporting. A similar effect can be expected based on the theory of "international product differentiation," which holds that exporting industries sell products that are especially atractive on international markets, and thus earn a rent in these market.[40]

Caves, however, argued that exports can induce domestic producers to adopt more competitive pricing policies. The reason is that, in response to foreign demand, a monopoly (and, possibly, an oligopoly) seeking profit maximization, but unable to set separate price scales for each market, would expand total output, reducing domestic prices.[41] One need only assume, however, that the mono-

[38] For this reason, when Carvalho and Haddad (1978, pp. 3-26) regressed the effective tariffs (calculated for the FIBGE 4-digit classification) for a set of variables, among them the concentration, coefficient they interpreted the regressions not as an explanatory model for the tariff structure but as a "statistical instrument for determining the sign and significance of the partial coefficient of correlation between effective protection rates and the independent variables".

[39] Neuhaus and Lobato (1978).

[40] Gruberl (1967, pp. 374-88). However, most industrial products exported by Brazil would hardly fall into this category.

[41] Caves (1974).

poly can discriminate its prices — and Brazil's high tariff barriers allow this — for the domestic price not to be affected.

In the Brazilian case in particular, the existence of various fiscal and financial incentives should contribute to the maintenance of a positive relation between exports and profitability.[42] To the extent that these incentives, which vary from one industry to another, imply a shift of the surplus supply curve, each industry will export more or less, depending — given an absence of distortions (imperfect information, varying capacities for utilization of incentives, etc.) — on the magnitude of such a shift in relation to international price levels. In any case, the hypothesized positive relationship holds, since the growth of demand can lead to: a) greater utilization of installed capacity, or, at a second stage, of long-term equilibrium; or b) to taking advantage of economies of scale.

2.1.6 — Participation of multinational companies

The effects of the participation of multinationals on the profitability of industrial sectors is too complex to be included in a single hypothesis. Not only do they affect the structure and patterns of behavior, but they also introduce other issues whose effects on profitability are not so entirely predictable.

One argument holds that foreign investment increases competition since the entry of multinational companies increases the number of competitors. In addition, as these companies tend to penetrate precisely those sectors protected by high duties, they will affect those industries where monopoly distortions are greatest. If foreign investments induce these competitive effects, one would expect the profitability of local firms to relate inversely to the foreign firms' share of the industry's total output.

On the other hand, the multinationals' competitive strategy based mainly on product differentiation, can raise entry barriers and, as a result, the price limits observed by established firms (both local and foreign). It is also possible that the entry of multinational companies might provoke the defensive alliance of domestic companies, facilitating oligopolist collusion. Since these latter considerations would suggest a positive relationship between these companies' participation and industry profitability, the final effect produced by structural modifications and behavioral patterns is not entirely clear.

As for the other problems the presence of multinational poses for the model, the first concerns the assumptions of profit maximi-

42 There are several descriptions of these incentives. See, for example, Carvalho and Haddad (1978a, pp. 105-35).

zation. As long as the decision-making center remais in the home country and the home-office holds to a policy of world-wide profit maximization, the profitability of any given subsidiary may become a secondary objective. Real profits may also be underestimate due either to explicit forms of transfers among affiliated companies (royalties, technical assistance, interest payments, etc.) or to transfer pricing mechanisms (undercharging for exports and overcharging for imports). Given the obvious difficulties in verifying this phenomenon, only the first will be compensated for here, with the inclusion of those transfers in profits. [43]

Another issue generally overlooked in this type of study is that of differences in the quality of management among firms. This question acquires particular relevance when dealing with the distribution among multinational and local firms in developing countries.

These differences arise for two reasons. [44] First of all, in addition to capital the multinationals transfer business technology (including accounting, marketing, organizational and administrative techniques). Secondly, certain socio-economic characteristic, such as the lack of a capitalist drive, the tradition of family control of companies and the resulting reluctance to decentralize decision-making, place local companies at a disadvantage in relation to the multinationals.

Since these factors make an *a priori* judgement on the final effect of the participation, of multinational companies on profitability impossible, this relationship will of necessity be determined empirically.

With the incorporation of the international factors, the model is expanded to:

$$\pi = \pi\ (CR,\ BE,\ DP,\ CD,\ CE,\ OE,\ EM) \qquad (3)$$

with the new symbols,

CE = foreign competition

OE = export opportunities

EM = participation of multinational companies

and with the following signs predicted.

$$\partial\pi/\partial CE < 0,\ \partial\pi/\partial OE > 0 \quad \text{e} \quad \partial\pi/\partial EM \gtrless 0 \qquad (3b)$$

43 Without introducing corrections in the accounting data, Doellinger and Cavalcanti (1975) found a net profit to net assets ratio that is lower for multinationals (15.8%) than for private Brazilian (16.4%) and government (17.6%) companies. However, they present an interesting discussion on why that ratio is underestimated.

44 For an extensive discussion of this problem, see Strassman (1968).

We must finally consider the possible differentiation of profit rates as the result of varying degrees of risk associated with each activity. There is no concensus on the extent to which risk contributes to inter-industry differences in profitability. Bain suggests that while risk may be a valid explanation at the level of the individual firm, the same is not true by industry. His argument is that, over the long run, the risk premia earned by successful firms would be compensated for by the losses of unsuccessful firms, whereby a "weighted average profit rate for all firms in the economy or in the industry should include a true net risk return of roughly zero."[45] Perhaps for this reason, all industry-level studies, with the exception of Stigler's (1963, pp. 62-4), have excluded consideration of risk. In any case, since this is a cross-section study lacking the time dimension required for the compensation suggested by Bain, we have decided to explicitly include a risk variable.

Thus, the basic model becomes:

$$\pi = \pi\ (CR,\ BE,\ DP,\ CD,\ CE,\ OE,\ EM,\ TR) \qquad (4)$$

where TR is a risk variable, and it would be expected that

$$\partial\pi/\partial TR > 0 \qquad (4b)$$

2.2 – Specification of the model

From an econometric point-of-view, the estimation in equation (4) involves three types of problems. The first arises from the fact that this equation is actually a direct relation between a performance variable (profitability) and a set of structural variables produced by a system that, formally, should include two behavioral equations – one expressing performance as a function of behavioral variables, which in turn should be an explicit function of the relevant structural characteristics. However, given the difficulty of quantifying the concept of behavior and the resulting rationalization suggested by Bain (see item 2.1), equation (4) expresses the analytical formulation most common in empirical studies.

The second problem refers to the possibility of interactive effects among the structure's components of behavior and performance, graphically represented by the broken lines in Chart 1 – which suggests the presence of a system of simultaneous equations demanding appropriate methods of estimation. This issue has been dealt with by assuming that the possible interactive effects occur

[45] Bain (1968, pp. 399-400).

with a sufficient time lag for the system to be considered recursive — thus allowing the estimation of one equation at a time.[46]

The third problem is that the underlying theory in the development of equation (4) does not indicate the precise manner in which the explanatory variables affect private profitability. However nearly all empirical studies have postulated a general linear form such as

$$\pi = \beta_o + \sum_{i=1}^{n} \beta_i X_i + \varepsilon \qquad (5)$$

where the coefficients β can be estimated by the conventional ordinary least squares (*OLS*) method.

The basic model can thus be specified as follows:[47]

$$\pi_j = \beta_0 + \beta_1 CR_j + \beta_2 PO_j + \beta_3 KR_j + \beta_4 DP_j + \beta_5 CD_j + \beta_6 CE_j + \\ + \beta_7 EX_j + \beta_8 EM_j + \beta_9 DG_j + \beta_{10} TR_j + \varepsilon_j \qquad (6)$$

where:

π_j — average profitability in industry j, during the period 1973-1975, which can alternatively be expressed as:

TRV_j = average rate of return to sales:

TRE_j = average rate of return to net equity;

CR_j = concentration ratio for industry j, in 1974, which can alternatively be expressed as:

$CR4_j$ = percentage of sales controlled by the industry's four largest firms;

$CR8_j$ — percentage of sales controlled by the industry's eight largest firms;

HH_j = Herfindahl index;

[46] Cowling (1976, p. 1). When the system is not recursive, that is, when there are feedback effects, the application of OLS gives biased estimators, since the explanatory variables are not independent of the residuals (Murphy, 1973, pp. 435-36).

[47] This is the specification of model 1 (see item 2.3.1). Due to the different ways in which the data are utilized in models 2 and 3, their specifications undergo some changes, mainly in the choice of measures, and also in the time periods to which they refer (see appendix).

PO_j = optimal plant size in industry j, in 1970;

KR_j = amount of capital required for construction of *optimal size plant* in industry j, in 1970;

DP_j = advertising intensity in industry j, in 1974;

CD_j = rate of growth of output in industry j, from 1967-72;

CE_j = foreign competition facing industry j, measured alternatively by:

CI_j = rate of growth of imports, 1970-74;

IM_j = share of imports in domestic consumption, 1967-72;

CM_j = rate of growth of IM_j, 1967-72;

EX_j = average ratio of exports to output of industry j, 1967-72;

EM_j = share of multinational companies' output in total output of industry j, in 1972;

DG_j = index of geographic dispersion of industry j, in 1970;

TR_j = risk index associated with industry j, measured by standard deviation of firms' rate of profitability, in 1974.

Besides equation (6), various other specifications of each model will be used, as discussed below.

The first group of alternative formulations refers to the applicability of the econometric estimation method to this type of study. Possibly the most serious problem posed by the application of *OLS* method to equation (6) is the frequently high degree of multicolinearity among the model's independent variables. In these situations, the parameter estimates are remarkably unstable (highly sensitive to the type of model specification and to the sample used), making it difficult, if not impossible, to isolate the effects of the pertinent variables.[48]

The most frequently used form of detecting and evaluating multicolinearity, and the one which will be used in this study, is the examination of the magnitude of the simple coefficients of

48 Johnston (1972, p. 160).

correlation among the independent variables.[49] High coefficients suggest that the variables in question should not be included in the same regression equation, which, on the other hand, can create the no less serious problem of a specification bias, to the extent that the omitted variable plays an important role in the model.[50] In these cases, the solution depends "on the judgement of the econometrician concerning the relative merits of low variances of the β estimators, high R^2 and low specification bias."[51]

Our option has been to select a basic set of variables suggested by the theory, to which we have progressively added the other variables, taking account of the restriction imposed by the simple coefficients of correlation (not greater than 0.80).

A second possible estimation problem which might make alternative specifications to the basic model necessary is heteroscedasticity. In this case, the β coefficient estimators, while not biased, lose their efficiency, that is, they do not show the minimum variance among the linear estimators. There are two possible solutions:

a) to maintain the *OLS* method, but to weight the variables with some empirically determined system;

b) to substitute the *OLS* method by the method of generalized least squares, of which the preceeding item is a particular case

Few studies to date have dealt with this problem; at the industry level, Comanor and Wilson's study is the only attempt. They observed an inverse relation between regression residuals and industry size (measured by sales) and, empirically, selected the square root of sales as the weighting system to be employed. However, besides the predicted increase in coefficient R^2, the new calculations

49 A more rigorous treatment of multicolinearity would involve measurement of the *multicolinearity effect* (M), given by

$$M = \left| \sum_{k=2}^{k} \theta_k - R^2 \right| \text{ where } \theta_k \text{ is the incremental contribution of variable } X_k$$

(Theil, 1971, pp. 179-81); and by the dependency test among the variables of set $\{X_k\}$, through calculation of the determinant of the matrix of simple correlation coefficients, $|R^*|$. The null hypothesis, indicating severe multicolinearity, would be $H_o : |R^*| = 0$, as opposed to $H_1 : |R^*| > 0$ (Murphy, 1973, pp. 377-9).

50 Actually, this is the most serious problem posed by multicolinearity, according to Farrar and Glauber (1967, pp. 94-5).

51 Murphy (1973, pp. 374-5). Johnston's suggestion is to opt for the error of including, rather than excluding, variables, as long as this is allowed by the data and the size of the sample (Johnston, 1972, p. 169).

did little more than offer additional evidence on the stability of the regression coefficients. Therefore, the issue of heteroscedasticity will only be examined in the individual form model, where the problem is more serious (see item 3).

Equation (6) and its alternative formulations suggested above are all linear; such functions may be represented graphically by straight lines (or their equivalents, in n-dimensional space). This restriction can be relaxed with the use of non-linear models in which additional terms — or first-degree mathematical transformation of terms — allow for adjustment of curves instead of straight lines. [52]

The reason for this addition is that, when the true relation is non-linear, the estimation of a linear function leads to a specification bias and, therefore, biased estimates of the regression coefficients, as well as to an underestimation of values of the Student t statistics. [53] Therefore, some of the preceding equations will be rewritten to include polinomial terms, depending on the presence of curvilinearity detected empirically by plotting the residuals against the independent variables, as suggested by Draper and Smith. [54]

The final problem is that all these models are additive, in the sense that they do not capture the incentive effects of structural variables on profitability. [55] These effects can be analyzed in the following manners: [56]

a) by specification of an iteractive model;

b) by including iteractive (multiplicative) terms in interactive models;

c) by estimation of additive model parameters for subgroups of the sample (for example, one would expect that coefficient *BE* will be greater and more significant as the *CR* level also increases).

We have opted here for the second mode of analysis.

52. However, these are "intrinsically linear" models, in the terminology of Draper and Smith (1966, p. 264), able to be transformed into linear equations. This part will follow the method as applied by Connor (1977, pp. 188-202).

53. Kmenta (1971, pp. 86-92).

54. Whenever polinomials are used, the t statistic will be replaced by the partial F statistic in the significance tests, since they are essentially an alternative way of expressing the same concept.

55. Two independent variables interact when the effect of one of them on the dependent variable depends on the level of the other.

56. Gale (1972, p. 412). See also Kim and Kohout (1970, pp. 372-3). The multiplier term represents the "joint effect", which should be added to the isolated effects of the variables in question.

2.3 — Empirical findings

2.3.1 — Model 1

Table 1 presents the main results of an application of the basic model to the 20 *SRF* 2-digit level industries, with TRV_j as the dependent variable.[57]

Due to the strong correlation among some of the explanatory variables, and the limited size of the sample (20 observations), the industries' structural characteristics are represented only by the concentration ratio ($CR4_j$ or HH_j), which thus serves as a proxy variable for industrial structure.

The concentration ratio and the rate of growth of demand (CD_j) are the basic variables, to which were successively added a measure of foreign competition (IM_j) and another for risk (TR_j).

In general, the signs of the variables are as predicted by the theory, although they are not always statistically significant. The concentration ratio, measured by $CR4_j$ or HH_j, was found to be statistically null when introduced in the conventional linear form. Given the importance of this variable in characterizing the industries' structural conditions, along with the fact that it is the only variable which when plotted against the residuals reveals a behavioral pattern suggesting the absence of linearity in the parameters, it has been attempted to improve its specification by adding to the first degree term, alternately and jointly, a quadratic and a cubic term. While, as could be expected, they did improve the model's explanatory power, they remained non-significant, even when variable IM_j, which accounts for foreign competition, was introduced. Only with the inclusion of the risk variable (TR_j), did the coefficients of the polinomial expressions become significant (to a 5% confidence level). This occurred with the three polinomial expressions when the concentration variable was $CR4_j$, and only with the expression with the cubic term when employing the Herfindahl index (HH_j).[58]

[57] In contrast to the other models estimated in this article, in model 1 the variable TRV_j does not refer to industry sales, but to total revenue, including, therefore, non-operating revenue.

[58] When the three polinomial terms are estimated by OLS, the underlying relationship is represented by a curve with two critical points: a maximum and a minimum. When only the quadratic or cubic term is included, the form described is a parabola, with only one critical point. The only difference is that the first curve is symetric in relation to its axis, while the second may be assymetric. When only the quadratic term is included, the second partial derivative is always positive, suggesting that profitability rises, exponentially with concentration. Even when a curve allows a point of inflection, the fact that more than one formulation may prove significant does not imply any inconsistency, inasmuch as the curves retain the same concavity in the relevant section.

In an attempt to capture non-linear effects in a sample as small as this, equations 5, 6 and 7 (Table 1) were estimated in a compact form summing polinomial terms.[59] We thus obtained linear estimators significant at the 5% level in equations 12 and 13 (Table 1).

The demand growth rate (CD_j) showed the predicted signs in 16 of the 17 regressions of Table 1 (the opposite sign is, nevertheless, statistically null). Five of them are significant at the level of 10% and two others at 5%.

The foreign competition variable (IM_j) revealed the predicted sign in the 13 equations in which it appeared, but was significant in only four (three at a 10% confidence level, and once at 5%).

The risk index (TR_j), in addition to showing the predicted sign and being significant in 9 of 12 equations, apparently corrected a specification error, since only when it was included did the polinomial expressions in $CR4_j$ and HH_j acquire significance.

A comparison of the 17 equations in Table 1 suggests that number 9 is the best specification of the model, when applied at a 2-digit level for the 1973-75 period. It explains 67% of the variation of TRV_j and all of its coefficients show the predicted signs and are statistically significant.

The basic model was also designed to have a dependent variable TRE_j. However, due to the weak results obtained, these regressions have not been reported.

Despite the model's apparently greater capacity for explaining the variation of TRV_j than that of TRE_j, and our option in favor of the first variable, the problem remains that TRV_j does not necessarily equalize in long-term competitive equilibrium. This creates difficulties for those who prefer to identify the exertion of market power with the tendency toward the equalization of rates of return to capital. However, to reconcile the two models it is enough to control the capital intensity differences when the dependent variable is TRV_j, which can be accomplished by including that variable explicitly in the model.[60] Since it is essentially a control variable, it is not so important to determine *a priori* the sign for capital intensity.

Table 2 presents the results of model's estimation, with the inclusion of this variable, which was defined as:

59 This procedure is equivalent to a lincarization of the basic relationship. in which the coefficients of regression are assumed to be equal in value and sign.

60 Tintner. (1952. pp. 301-4).

$$KV_j = \frac{\text{total assets of industry } j^{61}}{\text{sales of industry } j}$$

Only the equations whose results were at least not inferior to those of corresponding equations in Table 1 have been displayed.

In general, there were no significant gains, with the exception of equations 3, 4 and 5, which correspond to equations 8, 9 and 10 in Table 1 — precisely the best of that group.

The sign of KV_j is always positive and significant. While it has been included in the model basically as a control variable, it may be detecting some of the entry-barriers effect (the amount of capital required), as in House's interpretation (1973, p. 411).

2.3.2 — Model 2

Table 3 summarizes the main results of the estimations of the basic model using the data of *Visão's* classification of 42 industries.

While, as in model 1, the best results were obtained using TRV_j as the dependent variable, some regressions explaining the variation of TRE_j were also included in the table. In the latter case, while some of the coefficients were significant, the low values assumed by statistic F do not deny the hypothesis that, on the whole, those coefficients are statistically null (with the exception of equation 33).

The greater significance of the polinomial expression compared to the first degree term (which is always non-significant when included alone) reinforces the results of the previous model regarding the non-linear relationship between TRV_j and $CR4_j$. The same is the case when the index $CR4_j$ is corrected to incorporate foreign competition ($CR4_j^*$).

On the other hand, when the dependent variable is TRE_j, the polinomial expressions in $CR4_j$ are always statistically null, while the first-degree term is significant (at 10%) in two of the three equations in which it appears alone (equations 5, 13 and 21) — which suggests that the linear relationship is a more appropriate representation of the relationship between these two variables.

The rate of growth of demand (CD_j) and foreign competition (IM_j) maintain the same pattern of behavior as in the first model. Both present the predicted signs, but only the first passes the significance test (at the 1% level, in half of the 34 regressions in Table 3).

61 The measure KV_i was obtained by aggregating, at the 2-digit level, the data from the firms in the *Visão* sample (average of the 1973-75 period).

Table 1

Model 1 — Main Empirical Findings Dependent Variable: TRV_j

Number of observations = 20

Number of equation	Constant	Variables											R^2	F
		$CR4_j$	$CR4_j^2$	$CR4_j^3$	CD_j	IM_j	TR_j	$CR4Q_j$	$CR4C_j$	$CR4QC_j$	HH_j	HH_j^2	HH_j^3		
1	0,0136	0,0002	—	—	—0,0001	—	—	—	—	—	—	—	—	0,0723	0,66
	(4,39)[a]	(1,14)			(—0,05)										
2	0,0737	—0,0021	0,0001	—	0,0007	—	—	—	—	—	—	—	—	0,4642	4,62[b]
	(6,28)[a]	(——0,12——)			(1,03)										
3	0,0623	—0,0011	—	0,0001	0,0009	—	—	—	—	—	—	—	—	0,5154	5,67[a]
	(7,03)[a]	(——0,13——)			(1,28)										
4	0,0282	0,0018	—0,0001	0,0001	0,0011	—	—	—	—	—	—	—	—	0,5709	4,99[b]
	(1,09)	(——0,09—— | ——)		(1,59)[c]										
5	0,0738	—0,0021	0,0001	—	0,0008	—0,0067	—	—	—	—	—	—	—	0,4649	3,26[b]
	(6,07)[a]	(—— 0,28 —— |)		(0,87)	(—0,15)									
6	0,0277	0,0018	—0,0001	0,0001	0,0010	—0,0049	—	—	—	—	—	—	—	0,5713	3,73
	(1,02)	(——0,33——)			(1,67)[c]	(—1,12)									
7	0,0018	0,0001	—	—	0,0007	—0,0597	0,2013	—	—	—	—	—	—	0,3073	1,66
	(0,08)	(0,50)			(0,62)	(—0,95)	(2,21)[b]								
8	0,0330	—0,0022	0,0001	—	0,0017	—0,0837	0,1897[b]	—	—	—	—	—	—	0,6648	5,55[a]
	(1,91)[b]	(——0,17 ——)[b]			(2,07)[b]	(—1,83)[b]	(2,89[b]								
9	0,0253	—0,0012	—	0,0001	0,0016	—0,7263	0,1697	—	—	—	—	—	—	0,6738	5,78[a]
	(1,56)[c]	(——0,34——)[b]			(2,06)[c]	(—1,62)[c]	(2,60)[b]								
10	0,0222	0,0008	—0,0001	0,0001	0,0016	—0,0685	0,1626	—	—	—	—	—	—	0,6745	4,49[b]
	(0,90)	(———3,93——)[b]			(1,95)[b]	(—1,30)	(2,03)[b]								
11	0,0061	—	—	—	0,0005	—0,0483	0,1826	0,0001	—	—	—	—	—	0,3727	2,04
	(0,29)				(0,53)	(—0,80)	(2,07)[b]	(1,15)							
12	0,0094	—	—	—	0,0005	—0,0405	0,1656	—	0,0001	—	—	—	—	0,4104	2,61
	(0,47)				(0,55)	(—0,71)	(1,96)[b]		(1,71)[c]						
13	0,0094	—	—	—	0,0005	—0,0405	0,1658	—	—	0,0001	—	—	—	0,4096	2,60
	(0,47)				(0,55)	(—0,71)	(1,96)[b]			(1,70)[c]					
14	0,0023	—	—	—	0,0008	—0,0650	0,2036	—	—	—	0,0211	—	—	0,3125	1,70
	(0,11)				(0,75)	(—1,10)	(2,31)				(0,61)				
15	0,0067	—	—	—	0,0015	—0,0858	0,1858	—	—	—	—0,2302	0,7064	—	0,4317	2,13
	(0,33)				(1,44)[c]	(—1,51)[c]	(2,22)b				(——3,64——)				
16	0,0095	—	—	—	0,0014	—0,0746	0,1666	—	—	—	—0,1598	—	1,4600	0,4563	2,35
	(0,48)				(1,46)[c]	(—1,36)[c]	(2,00)[b]				(———3,81———)[b]				
17	0,0176	—	—	—	0,0000	—0,0281	0,1077	—	—	—	0,1777	—2,6945	6,4727	0,4954	2,13
	(0,82)				(0,88)	(—0,39)	(1,06)				(———2,54———)				

OBS.: 1. $CR4Q_j = CR4_j + CR4_j^2$

$CR4C_j = CR4_j + CR4_j^3$

$CR4QC_j = CR4_j + CR4_j^2 + CR4_j^3$

2. Letters a, b and c indicate that the regression coefficients are statistically significant at the levels of 1,5 and 10% respectively. The values in parenthesis are the Student t statistics and, in the case of the polinomial expression, partial F statistics. We have used unilateral tests, since the expected relationship between TRV_j and each of the independent variables is perfectly clear.

Table 2

Model 1 — Main Empirical Findings, With Capital Intensity (KV_j) *as a Control Variable Dependent Variable*: TRV_j

Number of observations = 20

Number of equation	Constant	Variables								
		$CR4_j$	$CR4_j^2$	$CR4_j^3$	CD_j	KV_j	IM_j	TR_j	R^2	F
1	0,044	0,0002	—	—	—0,0001	0,0001	—	—	0,0781	0,45
	(4,25)[a]	(0,93)			(— 0,08)	(0,32)				
2	0,0759	— 0,0022	0,0001	—	0,0007	0,0001	—	—	0,4868	3,56[b]
	(6,24)[a]	(——0,25——)			(0,98)	(0,81)				
3	0,0650	—0,0013	—	0,0001	0,0008	0,0001	—	—	0,5548	4,67[b]
	(7,15)[a]	(——0,41——)			(1,27)	(1,15)				
4	0,0099	0,0035	—0,0001	0,0001	0,0012	0,0001	—	—	0,6827	6,02[a]
	(0,40)	(——0,41——)			(1,97)[b]	(2,22)[b]				
5	0,0759	—0,0022	0,0001	—	0,0007	0,0001	—0,0010	—	0,4868	2,66
	(6,02)[a]	(——0,47——)			(0,75)	(0,77)	(0,02)			
6	0,0650	— 0,0013		0,0001	0,0008	0,0001	0,0022	—	0,5549	3,49[b]
	(61,91)[a]	(——0,54——)			(0,93)	(1,11)	(0,05)			
7	0,0054	0,0040	— 0,0001	0,0001	0,0001	0,0001	0,0274	—	0,6946	4,93[a]
	(0,21)	(——0,48——)			(1,14)	(2,29)	(0,71)			
8	0,0317	— 0,0024	0,0001	—	0,0016	0,0001	—0,0830	0,2120	0,7255	5,73[a]
	(1,95)[b]	(—— 8,21——)[a]			(2,13)[b]	(1,70)	(— 1,93)[b]	(3,36)[a]		
9	0,0240	— 0,0013	—	0,0001	0,0016	0,0001	—0,0718	0,1938	0,7528	6,60[a]
	(1,64)[c]	(——9,12——)[a]			(2,22)[b]	(2,04)[b]	(— 1,77)[b]	(3,23)[a]		
10	0,0019	0,0015	— 0,0001	— 0,0001	0,0014	0,0001	— 0,0417	0,1497	0,7815	6,13[a]
	(0,08)	(——6,35——)[a]			(2,02)[b]	(2,42)[b]	(— 0,90)	(2,18)[b]		

OBS.: Letters a, b and c indicate that the coefficients of regression are statistically significant at the levels of 1, 5 and 10% respectively. The values in parenthesis are the Student t statistics and, in the case of the polinomial expressions, partial F statistics. We have used unilateral tests, since the expected relationship between TRV_j and each of the independent variables in perfectly clear.

Table 3

Model 2 — Main Empirical Findings

Number of observations = 42

Number of equation	Dependent Variable	Constant	Variables										R^2	F
			$CR4_i$	CR_i^2	$CR4_i^3$	CD_i	IM_i	ZX_i	$CR4_i^*$	$CR4_i^{*2}$	$CR4_i^{*3}$	FO_i		
1	TRV_i	0,0736 (5,00)[a]	0,0161 (0,06)	—	—	0,1131 (3,20)[a]	—	—	—	—	—	—	0,2159	5,37[a]
2	TRV_i	0,1273 (4,53)[a]	—0,2186 (—5,66)[a]	0,2177	—	0,0986 (2,87)[a]	—	—	—	—	—	—	0,3048	5,55[a]
3	TRV_i	0,1169 (5,10)[a]	—0,1257 (—5,76)[a]	—	0,1439	0,0974 (2,86)[a]	—	—	—	—	—	—	0,3173	5,89[a]
4	TRV_i	0,0797 (1,05)[c]	0,1577 (3,82)[b]	—0,5975	—0,5035	0,0974 (2,85)[a]	—	—	—	—	—	—	0,3312	4,58[a]
5	TRE_i	0,1421 (6,21)[a]	0,0534 (1,40)[c]	—	—	0,0988 (1,80)[b]	—	—	—	—	—	—	0,1187	2,63
6	TRE_i	0,1500 (3,24)[a]	0,0191 (1,60)	0,0318	—	0,0967 (1,71)[b]	—	—	—	—	—	—	0,1196	1,72
7	TRE_i	0,1506 (3,95)[a]	0,0256 (1,61)	—	0,0281	0,0958 (1,69)[b]	—	—	—	—	—	—	0,1205	1,74
8	TRE_i	0,1111 (1,38)[c]	0,3267 (0,11)	—0,6346	0,4165	0,0957 (1,68)[b]	—	—	—	—	—	—	0,1279	1,36
9	TRV_i	0,0721 (4,80)[a]	0,0225 (0,85)	—	—	0,1166 (3,24)[a]	—0,0277 (—0,67)	—		—		—	0,2249	3,67[b]
10	TRV_i	0,1285 (4,57)	—0,2244 (—5,66)[a]	0,2318	—	0,1028 (2,98)[a]	—0,0405 (—1,02)	—		—	—	—	0,3237	4,43[a]
11	TRV_i	0,1168 (5,09)[a]	—0,1223 (—5,83)[a]	—	0,1504	0,1016 (2,96)[a]	—0,0384 (—0,98)	—		—	—	—	0,3345	4,65[a]
12	TRV_i	0,0868 (1,76)[b]	0,1047 (3,85)[b]	—0,4813	0,4440	0,1009 (2,92)[a]	—0,0327 (—0,81)	—		—	—	—	0,3431	3,76[a]
13	TRE_i	0,1406 (6,01)[a]	0,0301 (1,46)[c]	—	—	0,1026 (1,83)[b]	—0,2910 (—0,45)	—		—	—	—	0,1235	1,78
14	TRE_i	0,1509 (3,22)[a]	0,0145 (1,57)	0,0428	—	0,1000 (1,74)[b]	—0,0318 (—0,48)	—	—	—	—	—	0,1250	1,32
15	TRE_i	0,1505 (3,91)[a]	0,0276 (1,57)	—	0,0335	0,0992 (1,72)[b]	—0,0318 (—0,48)	—	—	—	—	—	0,1260	1,33
16	TRE_i	0,1166 (1,40)[c]	0,2856 (0,10)	—0,5447	0,3658	0,0985 (1,69)[b]	—0,0253 (—0,37)	—	—	—	—	—	0,1312	1,09
17	TRV_i	0,0714 (4,02)[a]	0,0039 (0,16)	—	—	0,1216 (3,47)[a]	—	0,0958 (1,61)[c]	—	—	—	—	0,2657	4,58[a]
18	TRV_i	0,1177 (3,97)[a]	—0,1908 (—7,25)[a]	0,1847	—	0,1063 (3,02)[a]	—	0,0616 (1,01)	—	—	—	—	0,3233	4,42[a]
19	TRV_i	0,1096 (4,47)[a]	—0,1124 (—7,33)[a]	—	0,1235	0,1044 (2,97)[a]	—	0,0531 (0,86)	—	—	—	—	0,3306	4,57[a]
20	TRV_i	0,0833 (1,70)[b]	0,0991 (4,80)[b]	—0,4531	0,4061	0,1025 (2,80)[a]	—	0,0394 (0,59)	—	—	—	—	0,3377	3,67[a]
21	TRE_i	0,1415 (6,09)[a]	0,0490 (1,24)	—	—	0,1012 (1,80)[b]	—	0,0266 (0,28)	—	—	—	—	0,1205	1,74
22	TRE_i	0,1464 (2,96)[a]	0,0294 (1,85)	0,0105	—	0,0996 (1,70)[b]	—	0,0230 (0,22)	—	—	—	—	0,1208	1,27
23	TRE_i	0,1470 (3,59)[a]	0,0305 (1,73)	—	0,0207	0,0983 (1,67)[b]	—	0,0194 (0,19)	—	—	—	—	0,1214	1,28
24	TRE_i	0,1111 (1,35)[c]	0,3264 (1,18)	—0,0340	0,4161	0,0958 (1,60)[c]	—	0,0001 (0,00)	—	—	—	—	0,1279	1,06
25	TRV_i	0,0727 (4,77)[a]	—	—	—	0,1219 (3,49)[a]	—	0,0978 (1,61)[c]	0,0011 (0,04)	—	—	—	0,2652	4,57[a]
26	TRV_i	0,1069 (3,54)[a]	—	—	—	0,1138 (3,23)[a]	—	0,0690 (1,07)	—0,1583 (—5,53)[a]	0,1692	—	—	0,2976	3,92[a]
27	TRV_i	0,0982 (3,05)[a]	—	—	—	0,1136 (3,22)[a]	—	0,0667 (1,03)	—0,0850 (—5,53)[a]		0,1140	—	0,2969	3,91[a]
28	TRE_i	0,1399 (5,70)[a]	—	—	—	0,1040 (1,86)[b]	—	0,0184 (0,19)	0,0614 (1,28)	—	—	—	0,1229	1,77
29	TRE_i	0,1441 (2,91)[a]	—	—	—	0,1027 (1,78)	—	0,0140 (1,86)	0,0371	0,0268	—	—	0,1232	1,30
30	TRE_i	0,1420 (3,51)[a]	—	—	—	0,1027 (1,78)[b]	—	0,0135 (1,80)	0,0481	—	0,0177	—	0,1232	1,30
31	TRE_i	0,1430 (1,03)[c]	—	—	—	0,1027 (1,75)[b]	—	0,1355 (0,12)	0,0471 (1,16)	0,0225	0,0162	—	0,1232	1,01
32	TRV_i	0,0901 (7,37)[a]	—	—	—	0,1163 (3,54)[a]	—0,0456 (—1,23)	—	—	—	—	0,0012 (2,87)[a]	0,3510	6,85[a]
33	TRE_i	0,1497 (0,79)[a]	—	—	—	0,1003 (1,88)[b]	—0,0382 (—0,63)	—	—	—	—	0,1410 (2,48)[a]	0,2034	3,23[b]
34	TRV_i	0,0891 (7,03)[a]	—	—	—	0,1167 (3,46)[a]	—0,0445 (—1,12)	0,0062 (0,09)	—	—	—	0,0987 (2,20)[b]	0,3511	5,01[a]

OBS.: 1. Letters *a*, *b* and *c* indicate that the coefficients of regression are statistically significant at the levels of 1, 5 and 10%, respectively. The values in parenthesis are the Student *t* statistics and, in the case of the polinomial expressions, partial *F* statistics. We have used unilateral tests, since the expected relationship between TRE_i and TRE_i and each of the independent variables in perfectly clear.

2. CR_i^* is the concentration ratio CR_i, corrected to account for foreign competition (see House, 1973).

Besides correcting the concentration ratio, this model broadens the previous one by including two more variables: a measure of sport opportunities (EX_j) and another for economies of scale (FO_j).

Although displaying the predicted sign, EX_j is significant in only two of the 16 regressions where it appears. For its part, FO_j also shows the expected sign, is always highly significant (at the 1% level in two regressions and 5% in the other) and in two equations (32 and 33) it produces the highest determination coefficient in the model, 35%. While it theoretically entails totally different consequences if compared to $CR4_j$, the construction of the empirical representation of FO_j is strongly correlated with the concentration ratio ($r = 0.84$), so that the two variables are not included simultaneously in the regression equations.

Because it allows for the construction of measures for a larger number of variables, only this set of data was used for the analysis of certain interactive effects suggested by the discussion on forms of association of the variables in the basic model. By introducing multiplying terms, we examined the interaction of the concentration ratio with the measure of entry barriers ($CR4FO_j$), with the geographical dispersion index ($CR4DG_j$), with the measure of foreign competition ($CR4IM_j$), with two measures of effective protection, with and without correction for currency overvaluation ($CR4PE_j$ and $CR4PS_j$), respectively, [62] and with the rate of growth of demand ($CR4CD_j$). The findings are summarized in Table 4.

Due to the strong multicolinearity which these multiplying terms normally display with these constituent, terms, the regressions were estimated with the three terms (the multiplying term and its two components) and with the suppression of one and then the other component term, since, due simply to the interrelated nature of the variables, the first estimate produced the opposite sign in one of the component terms. Although Table 4 shows only those regressions that maintain $CR4_j$, together with the multiplying term, in polinomial form, the results were equally consistent when the other term was maintained.

The multiplying terms generally give the predicted signs and are significant, except for $CR4IM_j$, $CR4PE_j$ and $CR4PS_j$. These results reveal the existence of important interactions among these variables in explaining the variation of TRV_j and, as a result, call for greater care in conventional interpretations of the regression coefficients.

[62] The measures of effective protection (PE and PS) are the simple arithmetic means of the effective tariffs calculated by Neuhaus for the IBGE 3-digit categories, aggregate to fit the *Visão* classification.

Table 4

Model 2 — Analysis of Interative Effects — Dependent Variable: TRV_i

Number of observations — = 42

Number of equation	Constant	Variables											
		$CR4_i$	$CR4_i^2$	$CR4_i^3$	CD_i	$CR4CD_i$	$CR4IM_i$	$CR4FO_i$	$CR4DG_i$	$CR4PE_i$	$CR4PS_i$	R^2	F
1	0,1003 (2,16)[b]	0,1180 (————	—0,5936 4,19 ————	0,5048)[b]	—	0,1832 (3,13)[a]	—	—	—	—	—	0,3544	5,08[aa]
2	0,0838 (1,71)[b]	0,1195 (————	—0,5102 3,77 ————	0,4616)[b]	0,1004 (2,90)[a]	—	—0,3605 (—0,68)	—	—	—	—	0,3367	3,70
3	0,1131 (2,52)[a]	—0,1640 (————	0,1934 7,79 ————	—0,1710)[a]	0,1075 (3,47)[a]	—	—	0,2624 (3,08)[a]	—	—	—	0,4704	6,39[a]
4	0,0758 (1,61)[c]	0,1254 (————	—0,6999 4,52 ————	0,5842)[a]	0,0976 (2,93)[a]	—	—	—	0,0009 (1,68)[c]	—	—	0,3801	4,41[a]
5	0,0819 (1,72)[b]	0,1742 (————	—0,5786 4,94 ————	0,4774)[a]	0,0886 (2,58)[a]	—	—	—	—	—0,0560 (—1,35)	—	0,3605	4,11[a]
6	0,0798 (1,66)[c]	0,1767 (————	—0,6237 4,74 ————	0,5126)[a]	0,0895 (2,58)[a]	—	—	—	—	—	—0,0006 (—1,12)	0,3537	3,94[a]

OBS.: Letters *a*, *b* and *c* indicate that the coefficients of regression are statistically significant at the levels of 1, 5 and 10%, respectively. The values in parenthesis are the Student *t* statistics and, in the case of the polinomial expressions, partial *F* statistics. We have used unilateral tests (see Note 1 to Table 3), with the exception of $CR4PE_i$ and $CR4PS_i$. For these variables, whose sign could not be determined *a priori*, we have used the bilateral test.

They do not fully represent the partial and individual impact of the variables involved – the interactive effects must be added to those of the isolated terms.

2.3.3 – Model 3

Table 5 presents the main results of basic model's estimations based on a sample of 48 industries at the 4-digit level, and with TRV_j as a dependent variable. [63]

Despite the model's high explanatory power (R^2 is approximately 95%), only the concentration ratio ($CR8_j$) and the rate of growth of demand (CD_j) were significant, especially the latter, whose t statistic is extremely high for the patterns of this study's findings. In addition, the quadratic term in $CR8_j$ suggests a positive relationship, which grows exponentially, between this variable and profitability.

The coefficients of the variables representing foreign competition (IM_j) and the presence of multinational companies ($EM1_j$) and ($EM2_j$), despite displaying the predicted signs, are statistically null. The product differentiation variable ($DP2_j$), on the other hand, shows an inverted sign, but is also statistically null.

3 – Performance determinants at the level of individual firms

3.1 – Analytical structure

The objective in this section is to formulate a model that can *explain* the differences in profit rates among Brazilian industrial firms. The starting point will be the adaptations already incorporated into the

[63] Of the 143 industries into which the firms in the sample are classified, 70 were ignored since it was impossible to obtain data for any variable from the matrix of observations [X]. In addition, to achieve greater representativity of these categories regarding the structure of the industries, we have eliminated the categories that: a) included less than nine firms; b) did not include at least one firm with a market share greater than 10%. Following elimination of these industries, we are left with the 48 industries in the sample used in the estimation of model 3. We must call attention to this imperfection in the construction of the sample, which, in any case, is justified as an attempt to generate data at a level of aggregation theoretically more appropriate to this type of study. In fact, the process of selection of the firms in the sample from IR-PJ (the listing of corporate income tax payers) comes from the 2-digit rather than 4-digit classification.

Table 5

Model 3 — Main Empirical Findings Dependent Variable: TRV_i

Number of observations = 48

Number of Equation	Constant	Variables							R^2	F
		$CR8_i$	$CR8_i^2$	DPS_i	CD_i	IM_i	BMS_i	BMI_i		
1	—7,2657 —(0,81)	0,5077 (1,69)[b]	—0,0043 —(1,88)[b]	—0,2247 —(0,51)	0,0303 (31,03)[a]	—	—	—	0,9584	347,67[a]
2	—7,1988 —(0,80)	0,5105 (1,69)[b]	—0,0043 —(1,89)[b]	—0,2310 —(0,53)	0,0302 (30,97)[a]	—	—	—	0,9583	246,80[a]
3	—7,3919 —(0,82)	0,5192 (1,71)[b]	—0,0043 —(1,88)[b]	—0,2149 —(0,48)	0,0302 (30,70)[a]	—0,1462 —(0,72)	—	—	0,9589	196,05[a]
4	—7,3206 —(0,81)	0,5215 (1,72)[b]	—0,0043 —(1,89)[b]	—0,2215 —(0,50)	0,0302 (30,63)[a]	—0,1411 —(0,69)	—	—	0,9587	195,18[a]
5	—6,7036 —(0,75)	0,4617 (1,51)[c]	—0,0039 —(1,71)[b]	—0,2718 —(0,61)	0,0301 (30,65)[a]	—	0,0268 (0,90)	—	0,9592	197,44[a]
6	—6,5926 —(0,73)	0,4508 (1,51)[c]	—0,0039 —(1,71)[b]	—0,2818 —(0,63)	0,0301 (30,63)[a]	—	0,0289 (0,97)	—	0,9592	197,30[a]
7	—7,0026 —(0,78)	0,4769 (1,58)[c]	—0,0040 —(1,78)[b]	—0,2985 —(0,67)	0,0301 (30,55)[a]	—	—	0,0296 (0,99)	0,9594	198,27[a]
8	—6,9157 —(0,77)	0,4773 (1,58)[c]	—0,0040 —(1,78)[b]	—0,3105 —(0,70)	0,0301 (30,54)[a]	—	—	0,0318 (1,06)	0,9594	198,63[a]

OBS.: Letters a, b and c indicate that the coefficients of regression are statistically significant at the levels of 1, 5 and 10%, respectively. The values in parenthesis are the Student t statistics and, in the case of the polinominal expressions, partial F statistics. We have used unilateral tests, since the expected relationship between TRV_i and each of the independent variables is perfectly clear.

basic model described in 2.1 for similar applications. In general, these adaptations involve the introduction — along with structural characteristics of the industry common to all the firms that make it up — of variables that will assume particular values for each firm.[64] Other variables will then be incorporated to account for certain institutional aspects of the Brazilian economy, as well as some effects of recent economic policies.

Essentially, the model can be displayed as follows, in linear form:

$$\pi_{ij} = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \sum_{j=n+1}^{m} \beta_j W_j + \sum_{k=m+1}^{l} \beta_k Z_k + \varepsilon_{ij} \quad (7)$$

where,

π_{ij} = profit rate for firm i, industry j

X_i = set of n structural variables which characterize the firm's industry

W_j = set of $(m - n)$ structural variables specifically related to the firm

Z_k = set of $(l - m)$ variables related to economic policy or institutional aspects affecting the firm or a particular group in which it is included.

In most of the model's applications at the firm level, set X_i is essentially the concentration ratio (CR), a proxy for product differentiation (DP) and the rate of growth of demand (CD).

When such information is available, the concentration ratio assigned to a diversified firm is the average (weighted by market shares) of the ratios pertaining to the industries in which it operates. Otherwise the index used is that of the industry comprising the firm's principal line of business. The latter is the procedure adopted in this study.

Corrections in the concentration ratio to account for foreign competition and the national or local scope of markets have not been considered in the known applications of the model for studies of individual firms. In any case, the data available for testing the

64 See especially Hall and Weiss (1965); Gale (1972); Kamerschen (1968, pp. 432-7); US Government, Federal Trade Commission (1969); and Shepherd (1972, pp. 25-37). The model used in this chapter is principally based on the first two articles. The same approach was taken by Jenny and Weber (1974), in their study for France, and by Caves and Uekusa (1976), for Japan.

model at the 4-digit aggregation level do not allow such corrections to be made. As a result, the concentration ratios are underestimated to an undetermined degree.

Advertising intensity (a proxy for product differentiation) and the rate of growth of demand has also been expressed as a ratio between individual firm and industry-wide data, without significantly altering conventional interpretations.

The third basic element of industry structure — barriers to entry — has been rationalized differently in the firm-level study, or has simply been ommitted. In the latter case, the measure of industrial structure has been restricted to the concentration ratio. Gale ande the Federal Trade Commission, for example, associated large market shares with scale economies and greater success in holding consumer loyalty via product differentiation.

As will be seen below in the presentation of the set of variables W_j, some elements of barriers to entry are included in the interpretations related to size (measured by total assets), market share and capital intensity.

3.1.1 — Firm size

The most common hypothesis on the size-profitability relation is that it is positive, due to imperfections in capital markets. Baumol (1967, chap. 5) and Steindl (1945, p. 33) argue that large firms enjoy all the options open to small firms and, in addition, can invest in activities which are not accessible to the latter due to their lack of capital. As a result, businessmen have an interest in accumulating capital as, among other things, a means of increasing profitability. [65]

One contending hypothesis, attributed mainly to Kaldor (1934, pp. 60-76) and Robinson (1958, pp. 39-40) suggests a negative relation between the two variables, on the basis of the possibility of diminishing returns to the fixed factor management. [66]

Empirical evidence on the size-profitability relation has also been quite ambiguous. In the USA, a recent study by Haines (1970, pp. 321-51) and two others done in the 1930s — Summers (1932) and Epstein (1934) — support the inverse relationship; Hall and Weiss (1965) and Steckler (1963), on the other hand, found a strong positive relation and others found the highest profit rates among

[65] Baumol (1967, p. 34).

[66] An interesting summary of the various contributions to analysis of this issue can be found in Williamson (1967, pp. 123-38).

medium-sized firms, with larger and smaller firms earning less.[67] In the countries of the European Economic Community studies to date have shown a negative relation between these variables.[68]

Despite the lack of clear indications from either economic theory or empirical evidence as to the true relationship between size and profitability, it is reasonable to assume a positive correlation for the following reasons, besides Baumol's and Steindl's arguments:

a) the drawback of administrative diseconomies seems to have been satisfactorily overcome by decentralization and other administrative techniques, in addition to technological advances — communications, computing, etc. — allowing a firm to grow considerably without running into diminishing returns as suggested by Kaldor and Robinson;[69]

b) the *pecuniary* economies of scale (lower prices in purchasing inputs due to the larger scale of operations) provide greater advantages for large firms than for the smaller ones;

c) the ability to raise capital at lower costs is clearly associated with larger firm size, not only because of the lesser risk but also because of possible monopsonic power;[70]

d) in addition, since they depend more substantially on internal generation of resources, smaller firms are more penalized by tax policies, which operate against their main source of financing — private capital accumulation;[71]

e) large firms have shown a greater capacity for utilization of the fiscal incentives provided by Brazilian tax law.[72]

67 See, for example, Osborn (1951, pp. 82-94); and McConnel (1945, pp. 6-12).

68 Jacquemin and Lichtbuer (1973) (all EEC countries); Jenny and Weber (1974) and Morvan (1967) (France); Samuels and Smith (1968, pp. 127-39) and Waite (1973, pp. 154-65) (England).

69 Sherer (1974, pp. 74-8).

70 Koch (1974, pp. 92, 93-100 and 138-9). See also US Congress, Senate Subcommittee on Monpoly of the Senate Select Committee on Small Business (1952); and Edwards (1965, pp. 1-34). Caves and Uekusa (1976, pp. 37-8) show that, in Japan, large firms pay at least 1/3 less than small firms for loan capital.

71 Waite (1973, p. 164).

72 Rezende (1975, pp. 49-50).

3.1.2 — Market shares

In the most complete study on the effect of a firm's market share on its profitability, Gale postulated a positive relationship, arguing that a greater market share:

a) offers the firm an advantage in product differentiation, since "consumers seeking to avoid risk tend to favor firms with large market shares";

b) gives the firm the wherewithal to participate in collusive agreements;

c) increases the firm's bargaining power within the oligopolistic group;

d) allows the firm to take greater advantage of economies of scale. [73]

It is clear however that the effect of market share on profitability depends on other characteristics of the firm and its industry as well — in particular on the level of concentration in the industry (the higher the more profitable). [74]

3.1.3 — Risk

Traditional theory suggests that investors are typically risk averse and, therefore, demand a premium for applications considered riskier. [75] One should thus expect a positive correlation between risk (normally measured by the variability of profits over a given period of time) and profitability. This is the hypothesis most frequently put forth in empirical studies on industrial organization. [76]

Yet several studies have shown that firms possessing market power show not only higher — as would be expected — but more stable rates of profitability, with lower variance. [77] For this reason, and also due to the greater difficulty in obtaining sufficiently long

[73] Gale (1972, pp. 423-4). See also Buzzell at al (1975, pp. 98-9).

[74] Gale (1972, p. 415); Shepherd (1972, p. 26).

[75] Tobin (1957, pp. 65-86).

[76] The rates of return compensated by risk thus balance out in the long-term competitive equilibrium.

[77] This finding could be tied to a possible preference for stability of profits over greater potential gains, implicit in the large firms' tendency towards diversification.

series to calculate variances in profits, empirical studies have resorted to other means of approximating risk indices, normally a measure of the dispersion of the rate of return.

At this point it would be helpful to discuss the theoretical implications of using leverage as a measure of risk, as suggested by Gale.[78] In this sense, Gale distinguishes business risk (which depends on the industry in which the firm is operating) and financial risk (associated with the percentage of debt capital).

According to Gale, there is an optimum leverage level for industries falling into the same class of risk and, under the risk aversion hypothesis, optimum indebtedness should correlate negatively with the rate of profitability (a firm will have higher leverage in a lower-risk industry). Financial risk, on the other hand, which is typically an intra-industry phenomenon, grows as the firm moves away from its industry's optimum leverage (towards greater indebtedness).

With the additional hypothesis that the dispersion of inter-industry optimum ratios is greater than that of actual intra-industry ratios, Gale postulated a negative net relation between leverage and profitability.

Despite a certain amount of empirical support for this hypothesis,[79] the use of leverage to measure risk is subject to two objections, both based on the fact that this ratio is also a measure of financial structure, which — and here lies the first objection — would have an independent (and positive) effect on profitability. It would reflect a businessman's opportunity to increase return to net equity.[80]

The second objection, put forth by Hurdle (1974, pp. 478-86) and Carleton and Silberman (1977, pp. 815-21), is that the relation between leverage and profitability cannot be defined *a priori,* since relation between these variables and risk depend on the firm's utility function and can thus only be empirically determined in the context of a more general model of simultaneous equations. This criticism actually reflects the traditional approach of financial theory, which — unlike industrial organization theory — tends to see the three variables as being simultaneously determined by an interctive set of management decisions and demand conditions, omitting structural aspects of the markets.

[78] Leverage has been measured by E/A, by D/E or by D/A, where: E = net equity; A = total assets; and D = loan capital. The measure used in this article is D/E.

[79] Gale (1972, p. 418); Jenny and Weber (1974, p. 950).

[80] Stigler (1963, p. 124); Sherer (1974, p. 80); and Jean (1970, pp. 133-40).

In terms of these divergent opinions on risk, this study will use the following line:

a) The analytical structure in terms of the (implicitly) reduced conventional form will be maintained, presenting profitability as a function of all the selected variables, without resorting to a more general model to look into inter-relations within a subset of variables.

b) A measure of risk will be adopted such as to be compatible with the limitation of the period covered by the sample (the variance of profitability of the firms in a given industry) and leverage will be interpreted as a variable of the financial structure, especially since — as shall be seen — there are reasons to predict that, in the Brazilian case, that financial conditions exert an independent effect or profitability, as in Stigler, Sherer and Jean's interpretation.

3.1.4 — Capital intensity

Capital intensity is not considered a structural element, although industries (and firms) differ, for technological reasons, as to the capital required to generate a given product value.

In some studies, it has been taken as a determining factor in creating entry barriers, thus positively affecting profitability. In other, it is a proxy for excess capacity, inverting the effect (Sato, 1961, pp. 361-425). However it is more often used as a simple control variable, merely to help isolate the precise influence of structural variables, which are normally the main focus of the studies.

In particular, when TRV is used to measure profitability, the explicit inclusion of capital intensity in the model becomes indispensable to account for variations caused exclusively by divergences in the capital-output ratio. In addition, whatever the measure of profitability used, inclusion of this variable is justified because it detects possible differences caused exclusively by alternate depreciation accounting methods, especially when the period analysed is not very long (as is the case here).

The third set of factor (Z_k) is made up of variables representing financial policies (reflected in the firm's financial structures) tax policies and possible differences tied to the origin of the capital (domestic or foreign).

3.1.5 — Financial structure

As seen in relation to risk, a high level of indebtedness (D/E) could correlate negatively with profitability, since it indicates low activity risk. A similar effect could be produced by excessive interest payments under imperfect conditions in the capital market.

Yet, in the Brazilian case, there are two reasons to suspect a positive relation between these variables, Brazilian firms' high indebtedness levels are less related to their activity risk than to:

a) the large amounts of subsdized credit available (long-term, low-interest, with pre-established inflation indexing and deductible interest payments);

b) the weak performance of the stock market (which leads companies to lose interest in this type of capitalization).[81]

Since conditions of access to official (subsidized) credit are not the same for all firms, nor are there possibilities of pecuniary economies of scale in the access to private credit, the model must explicitly incorporate these differentiated financing conditions to explain variations in profitability.

3.1.6 — Tax treatment

One reason for profitability differences observed in cross-section studies (inter-industry or, more typically, inter-firm studies) is the possibility of unequal tax treatment. Given no distortions, after-tax profitability rates would obviously tend to balance out in the long run, and there would be no need to include this aspect in a regression analysis.

In this case, however, two arguments support its inclusion. First of all, a three-year period could include situations of temporary departure from long-term equilibrium positions. More importantly, however, in Brazil there are not only different methods for calculation of profits, but also large possibilities for the use of fiscal incentives, which can reduce both the gross basis for calculation and the amount of taxes owed.[82]

81 Actually, these two motives are closely tied to, and fundamental results of, the preponderance of the state in the aggregate savings of the Brazilian economy.

82 Consult the *Manual de orientação da pessoa jurídica — imposto de renda*, 1977. Rio de Janeiro, MF/SRF, 1977.

The introduction of tax burden variables could thus identify any distortion or rigidity in the tendency towards equalization of profit rates not entirely detected by other variables such as size and market shares.

3.1.7 — Origin of capital

For the most part, the reasons for associating higher profitability with foreign (as opposed to domestic) capital have already been analyzed in section 2.1 (participation of multinational companies). These arguments can be summarized as follows:

a) management superiority;

b) more advanced technology and/or lower costs than domestic firms for obtaining access to equivalent technologies;

c) greater financing options (particularly important in periods of restrictive monetary policies), due to ties with overseas credit markets;

d) relatively large scale of operations by Brazilian standards;

e) tendency to operate in dynamic industries with rapidly expanding demand;

f) pattern of competition based on product differentiation in their respective markets, which heightens entry barriers and facilitates collusive arrangements.

On the other hand, the relation between profitability (measured conventionally from accounting data) and foreign participation in a firm's capital can also turn negative, in situation where:

a) the multinational's world-wide profit maximization strategy does not imply the same objective for the subsidiary;

b) local partners pressure for a greater distribution of profits. [83]

3.2 — Specification of the model

Based on the two preceeding sections, model (7) can be specified as follows:

$$\pi_{ij} = \beta_0 + \beta_1 CR_j + \beta_2 DP_j + \beta_3 CD_j + \beta_4 TA_{ij} + \beta_5 PM_{ij} + \beta_6 TR_{ij} + \\ + \beta_7 IK_{ij} + \beta_8 LV_{ij} + \beta_9 TJ_{ij} + \beta_{10} LT_{ij} + \beta_{11} IFD_{ij} + \\ + \beta_{12} IFX_{ij} + \beta_{13} OK_{ij} + DCIP_{ij} + \varepsilon_{ij} \qquad (8)$$

[83] Ness Jr. (1975, pp. 37-64).

with the new symbols meaning: [84]

TA_{ij} = size of firm i, belonging to industry j, measured by total assets

PM_{ij} = market share of firm i, belonging to industry j, measured by the share of its sales in total industry sales

TR_{ij} = risk index applicable to firm i, belonging to industry j, measured by the standard deviation of the industry's mean profit rate.

IK_{ij} = capital intensity of firm i, belonging to industry j, measured by the ratio of total assets to operating income

LV_{ij} = leverage of firm i, belonging to industry j, measured by the ratio of liabilities to net equity.

TJ_{ij} = effective interest rates paid by firm i, belonging to industry j, measured by the ratio of financial expenses to loans outstanding at the end of the preceding fiscal year or, alternatively, financial expenses to operating income

LT_{ij} = capacity of firm i, belonging to industry j, to reduce taxable profits, measured by the ratio of final taxable profits to real profits

IFD_{ij} = utilization by firm i, belonging to industry j, of fiscal incentives to regional and sectoral development, measured by the ratio of financial investment related to tax incentives to net equity

IFX_{ij} = utilization by firm i, belonging to industry j, of tax incentives to export, measured by the ratio of proceeds arising from the export of manufactured goods to operating income

OK_{ij} = origin of capital of firm i, belonging to industry j, measured by the percentage of capital held by foreign share holders in the total capital of the firm

$DCIP_{ij}$ = dummy variable, which assumes the value of 1 if the firm is subject to some form of price control, and zero, if it is not

[84] A more detailed description of the construction of each variable is to be found in the appendix.

Just as with the industry-level model (item 2.2), this model will be estimated through several *reduced forms*, to account for occurrences of multicolinearity, heteroscedasticity and departure of the variables from conditions of linearity.

3.3 — Empirical results

Table 6 presents the main results of the estimation of model (8), based on a set of 267 industrial firms, with TRV_j as a dependent variable. [85]

As with the industry model, we have defined two basic sets of structural variables, which differ only in the specification of the size variable. To each we have added variables representing the economic and institutional aspects the study seeks to analyse. [86] Two variables in these basic sets — market share (PMR_{ij}) and the rate of growth of demand (CDR_{ij}) — have been normalized to correspond to the specific conditions of the industry to which the firm belongs.

The variables composing these basic sets — market share (PMR_{ij}), adversiting intensity (DPA_{ij}), growth rate of demand (CDR_{ij}) and size (TAA_{ij}) — were of the predicted signs and explained about 15% of the variation of TRV_{ij}), a rate comparable to that observed in similar studies. Of these variables, size was the most important, significant at the 1% level in all equations, in both specifications. The negative sign of the quadratic term confirms the hypothesis of a positive relationship, but growing at decreasing rates, between size and profitability.

Intensity of advertising is always significant, but at a lower level of significance, 10%.

Market share and the rate of growth of demand, while of the predicted signs, are only significant when size is specified in the polinomial form.

Capital intensity (IK_{ij}), interpreted as a control variable, was always statistically null, possibly due to its strong correlation with other variables in the model, especially size ($r = 0.82$). For this reason, IK_{ij} was only maintained in equations 3 and 13.

The dummy variable, which identifies the existence of price controls ($CDIP_{ij}$), is negative and significant at the 1% and 5%

[85] The use of 267 firms instead of the total sample (549 firms) is due to the elimination of firms for which it was impossible to obtain data for any variable in matrix [X]. All the estimators are thus based on the same set of data.

[86] In the first set (the first 10 equations), the size variable was specified in logarithmic form, and in the second (the other 10 equations), a quadratic term was introduced.

Table 6

Individual Firm Model — Main Empirical Findings Without Correction for Heteroscedasticity Dependent Variable: TRV_{ij}

Number of observations = 267

Number of equation	Constant	Variables																
		PMR_{ij}	DPA_{ij}	CDR_{ij}	Log TAA_{ij}	$DCIP_{ij}$	IX_{ij}	LV_{ij}	OK_{ij}	DOK_{ij}	$IFD2_{ij}$	IFX_{ij}	$IJ2_{ij}$	LT_{ij}	TAA_{ij}	TAA^2_{ij}	R^2	F
1	16,4220	0,0459	0,0618	0,0384	0,8504	—	—	—	—	—	—	—	—	—	—	—	0,1613	11,68[a]
	(5,0382)[a]	(0,8490)	(1,5343)[c]	(0,9484)[a]	(5,1804)													
2	16,4454	0,0342	0,0593	0,0404	0,8989	−5,2086	—	—	—	—	—	—	—	—	—	—	0,1876	10,56[a]
	(5,0843)[a]	(0,6344)	(1,4831)[c]	(1,0598)	(5,4704)[a]	(2,2481)												
3	17,1695	0,0477	0,0633	0,0317	0,8547	—	−0,0468 x	0,0289	—	—	—	—	—	—	—	—	0,1505	8,039[a]
	(3,7095)[a]	(0,8782)	(1,5704)[c]	(0,8146)	(5,1815)[a]		−(1,0688)	(0,6787)										
4	15,7867	0,0468	0,0607	0,0378	0,8480	—	—	—	0,1368	—	—	—	—	—	—	—	0,1527	9,33[a]
	(4,1856)[a]	(0,8630)	(1,4999)[c]	(0,9781)	(5,1527)[a]				(0,3365)									
5	16,5842	0,0464	0,0617	0,0369	0,8211	—	—	—	—	0,0008	—	—	—	—	—	—	0,1540	9,50[a]
	(5,0787)[a]	(0,8591)	(1,5311)[c]	(0,9618)	(4,9063)[a]					(0,91)								
6	15,6283	0,0445	0,0617	0,0350	0,8268	—	—	—	—	—	0,0620	0,0191	—	—	—	—	0,1545	7,92[a]
	(4,6361)[a]	(0,8198)	(1,5244)[c]	(0,8978)	(4,9707)[a]						(0,4367)	(0,2341)						
7	14,5491	0,0513	0,0615	0,0315	0,8395	—	—	0,0290	—	—	—	—	−0,0126	—	—	—	0,1531	7,83[a]
	(3,4971)[a]	(0,9358)	(1,5174)[c]	(0,8058)	(4,7232)[a]			(0,6794)					(0,3881)					
8	18,0012	0,0290	0,0596	0,0417	1,0006	—	—	—	—	—	—	—	—	—	—	—	0,1676	10,51[a]
	(5,4402)[a]	(0,5350)	(1,4914)[c]	(1,0950)	(5,6875)[a]													
9	14,1565	0,0229	0,0598	0,0417	0,9841	—	—	—	—	—	—	—	—	0,0884	—	—	0,1839	9,77[a]
	(2,8365)[a]	(0,4245)	(1,4842)[c]	(1,1013)	(5,6335)[a]									(2,2811)[a]				
10	16,3364	0,0502	0,0609	0,0350	0,8651	—	—	—	—	—	—	—	—	—	—	—	0,1530	9,43[a]
	(5,0040)[a]	(0,9226)	(1,5121)[c]	(0,9094)	(5,3246)[a]													
11	22,9619	0,1094	0,0629	0,0670	—	—	—	—	—	—	—	—	—	—	0,0001	−0,0001	0,0982	5,88[a]
	(7,4780)[a]	(2,0244)[b]	(1,5060)[c]	(1,7231)[b]											(2,8993)[a]	−(2,3582)[a]		
12	23,2791	0,1027	0,0611	0,0717	—	−4,8771	—	—	—	—	—	—	—	—	0,0001	−0,0001	0,1082	6,28[a]
	(7,5950)[a]	(1,8027)[b]	(1,4871)[c]	(1,8463)[b]		−(1,7082)[b]									(2,9780)[a]	−(2,3822)[a]		
13	23,8318	0,1113	0,0643	0,0625	—	—	−0,0474	0,0277	—	—	—	—	—	—	0,0001	−0,0001	0,1033	4,26[a]
	(5,2896)[a]	(2,0442)[b]	(1,5379)[c]	(1,5802)[c]			−(1,0461)	(0,6263)							(2,8968)[a]	−(2,3618)[a]		
14	21,8041	0,1108	0,0608	0,0592	—	—	—	—	0,2414	—	—	—	—	—	0,0001	−0,0001	0,0993	4,78[a]
	(5,9310)[a]	(2,0453)[b]	(1,4508)[c]	(1,7688)[b]					(0,5744)						(2,9141)[a]	−(2,3820)[a]		
15	22,8818	0,1088	0,0630	0,0689	—	—	—	—	—	0,0011	—	—	—	—	0,0001	−0,0001	0,1041	5,03[a]
	(7,4804)[a]	(1,9783)[b]	(1,5107)[c]	(1,7212)[b]						(1,3048)[a]					(2,6030)[a]	−(2,0892)[b]		
16	21,5340	0,1050	0,0623	0,0640	—	—	—	—	—	—	0,0739	0,0369	—	—	0,0001	−0,0001	0,1048	4,33[a]
	(8,8353)[a]	(1,9342)[b]	(1,4880)[c]	(1,6415)[c]							(0,5050)	(0,4395)			(2,7337)[a]	−(2,2022)[b]		
17	19,5266	0,1173	0,0585	0,0574	—	—	—	0,0310	—	—	—	—	0,0586	—	0,0001	−0,0001	0,1068	4,42[a]
	(4,7284)[a]	(2,1563)[b]	(1,3987)[c]	(1,4480)[c]				(0,7004)					(1,4529)[c]		(2,8111)[a]	−(2,1781)[b]		
18	24,0030	0,1070	0,0821	0,0711	—	—	—	—	—	—	—	—	—	—	0,0001	−0,0001	0,1008	4,86[a]
	(7,2732)[a]	(1,9747)[b]	(1,4868)[c]	(1,8147)[b]											(3,0098)[a]	−(2,4615)[b]		
19	19,7678	0,0975	0,0611	0,0705	—	—	—	—	—	—	—	—	—	0,0934	0,0001	−0,0001	0,1187	5,03[a]
	(5,2877)[a]	(1,8116)[b]	(1,4745)[c]	(1,8161)[b]										(2,3800)[a]	(2,8001)[a]	−(2,2788)[b]		
20	22,8755	0,1122	0,0624	0,0664	—	—	—	—	—	—	—	—	—	—	0,0001	−0,0001	0,0987	4,75[a]
	(7,4685)[a]	(2,0524)[b]	(1,4821)[c]	(1,7058)[b]											(2,9150)[a]	−(2,3730)[a]		

OBS.: Letters *a*, *b* and *c* indicate that the coefficients of regression are statistically significant at the levels of 1,5 and 10%, respectively. The values in parenthesis are the Student *t* statistics and, in the case of the polinomial expressions, partial *F* statistics. We have used unilateral tests, since the expected relationship between TRV_{ij} and each of the independent variables is perfectly clear.

levels, depending on the logarithmic or polinomial specification of size, respectivelly. This result, which suggests lower profitability for firms subject to price controls, can be interpreted as evidence of government price-control actions in limiting the exertion of market power. This is true despite $DCIP_{ij}$'s strong correlation with variables having positive and significant effects on profitability, for example TAA_{ij} ($r = 0.65$) and log TAA_{ij} ($r = 0.79$).

The findings show weak evidence of association of foreign control with higher profit rates. Both the continuous variable (OK_{ij}) and the dummy (DOK_{ij}) show positive signs, but only the latter is significant (at 10%), and only in one equation (n.º 15).

The consequences of the firms' financial structure and, particularly, financial costs on profitability are represented by leverage (LV_{ij}) and by financial expenses normalized by sales ($TJ2_{ij}$). Both variables' coefficients are always positive, but only $TJ2_{ij}$ shows a coefficient statistically different from zero (at the level of 10% in equation 17, Table 6). These weak results are not entirely discouraging, since the significance of LV_{ij} was substantially improved by correction for heteroscedasticity (see Table 7).

Thus the results can be seen as supporting the hypothesis that despite its pressure on costs, indebtedness is an attractive policy for increasing profitability.

Tax treatment is represented by three variables: LT_{ij}, $IFD2_{ij}$ and IFX_{ij} (see description in Appendix).

LT_{ij} is positive and significant, counter to expectations that profitability would be positively associated with a firm's greater capacity to reduce taxable profits. One possible reason for this result is that it is precisely the most profitable firms that have more additons than subtractions from real profits, under the form of earnings paid to unidentified beneficiaries, excessive participation by directors in profits, etc., making final taxable profits higher than real profits. [87]

The variable designed to detect effects of subsidies implicit in fiscal incentives for regional sectoral development ($IFD2_{ij}$), despite

87 Final taxable profits differ from real profits due to the exclusion of some components and the inclusion of others. In this study, the main items excluded were: deductions related to the proceeds of the export of manufactures, the maintenance of turvoner capital and the participation of government agencies or companies in the profits of the firm and in losses from earlier fiscal years; the main items included were: earnings paid to unidentified beneficiaries, participation in profits and gratifications attributed to executives and administrators (in excess of legal limits), royalties or technical assistence deducted without observations of legal requirements and fines for fiscal infractions. It should be observed that this effect was strong enough to make up for the fact that one of the items excluded from real profits (deductions for export of manufactures) was added to the numerator of TRV_{ij} (see appendix) which could have induced an inverse variation between the two variables.

Table 7

Individual Firm Model — Main Empirical Findings With Correction For Heteroscedasticity Dependent Variable: TRV_{ij}

Number of observations = 267

Number of equation	Constant	Variables																
		PMR_{ij}	DPA_{ij}	CDR_{ij}	Log TAA_{ij}	$DCIP_{ij}$	IK_{ij}	LV_{ij}	OK_{ij}	OOK_{ij}	$HFD2_{ij}$	HFK_{ij}	$TJ2_{ij}$	LT_{ij}	TAA_{ij}	TAA^2_{ij}	R^2	F
1	35,1210	0,1130	0,1784	—0,0001	0,0021	—	—	—	—	—	—	—	—	—	—	—	0,7726	222,57[a]
	(2,3853)[a]	(2,5780)[a]	(4,5774)[a]	—(1,2666)	(8,2182)[a]													
2	34,9129	0,1131	0,1788	—0,0001	0,0021	0,0001	—	—	—	—	—	—	—	—	—	—	0,7726	177,40[a]
	(2,3555)[a]	(2,5731)[a]	(4,5681)[a]	—(1,2636)	(8,1732)[a]	(0,1442)												
3	31,2318	0,1124	0,1892	—0,0001	0,0018	—	—0,0386	0,1348	—	—	—	—	—	—	—	—	0,7889	154,46[a]
	(2,1208)[b]	(2,5470)[a]	(4,9067)[a]	—(1,0486)	(4,4867)[a]		—(0,9187)	(3,1104)[a]										
4	34,8858	0,1158	0,1921	—0,0001	0,0030	—	—	—	0,0001	—	—	—	—	—	—	—	0,7747	179,50[a]
	(2,3743)[a]	(2,6431)[a]	(4,8190)[a]	—(1,8139)[a]	(7,5254)[a]				(1,5598)[a]									
5	35,4001	0,1130	0,1783	—0,0001	0,0021	—	—	—	—	0,0001	—	—	—	—	—	—	0,7727	177,41[a]
	(2,3877)[a]	(2,5701)[a]	(4,5664)[a]	—(0,1936)	(6,1986)[a]					(0,1877)								
6	33,0280	0,1031	0,1771	—0,0001	0,0020	—	—	—	—	—	0,0177	0,0650	—	—	—	—	0,7737	148,17[a]
	(2,2221)[b]	(2,3005)[a]	(4,5322)[a]	—(0,1906)	(7,4930)[a]						(0,1064)	(0,5828)						
7	29,4655	0,1209	0,1678	—0,0001	0,0014	—	—	0,1275	—	—	—	—	0,0040	—	—	—	0,7802	153,83[a]
	(2,0025)[a]	(2,7815)[a]	(4,7215)[a]	—(1,1282)	(4,2857)[a]			(2,9614)[a]					(0,1188)					
8	40,6599	0,0741	0,1941	—0,0001	0,0026	—	—	—	—	—	—	—	—	—	—	—	0,7620	187,20[a]
	(2,7962)[b]	(1,8603)[a]	(5,0372)[a]	—(1,0517)	(8,8698)[a]													
9	26,6619	0,0129	0,1282	—0,0001	0,0022	—	—	—	—	—	—	—	—	0,2703	—	—	0,8251	204,49[a]
	(2,0255)[b]	(0,3160)[a]	(3,5454)[a]	—(2,2747)[a]	(8,0885)[a]									(8,0135)[a]				
10	34,4888	0,1054	0,1785	—0,0001	0,0021	—	—	—	—	—	—	—	—	—	—	—	0,7740	176,89[a]
	(2,3439)[a]	(2,3816)[a]	(4,5849)[a]	—(1,2583)	(8,2944)[a]													
11	38,1377	0,1707	0,2317	—0,0001	—	—	—	—	—	—	—	—	—	—	0,0001	—0,0001	0,7595	164,88[a]
	(2,4890)[a]	(3,8841)[a]	(6,1442)[a]	—(1,0507)											(0,8428)[a]	—(5,6116)[a]		
12	37,8665	0,1709	0,2325	—0,0001	—	0,0001	—	—	—	—	—	—	—	—	0,0001	—0,0001	0,7596	136,23[a]
	(2,4413)[a]	(3,8812)[a]	(6,1368)[a]	—(1,0487)		(0,2753)									(6,8172)[a]	—(5,4987)[a]		
13	24,8550	0,1611	0,2155	—0,0001	—	—	0,0049	0,1893	—	—	—	—	—	—	0,0001	—0,0001	0,7798	131,04[a]
	(1,8487)[c]	(3,7866)[a]	(5,8707)[a]	—(1,0129)			(0,1216)	(4,6118)[a]							(4,1674)[a]	—(5,2513)[a]		
14	37,1163	0,1726	0,2468	—0,0001	—	—	—	—	0,0001	—	—	—	—	—	0,7631	—0,0001	0,7631	139,60[a]
	(2,4345)[a]	(3,9478)[a]	(6,4495)[a]	—(2,1520)[b]					(0,9841)[b]						(6,1698)[a]	—(5,2517)[a]		
15	38,4600	0,1706	0,2316	—0,0001	—	—	—	—	—	0,0001	—	—	—	—	0,0001	—0,0001	0,7596	136,91[a]
	(2,4926)[a]	(3,8743)[a]	(6,1287)[a]	—(0,2113)						(0,2064)					(6,8275)[a]	—(5,4876)[a]		
16	35,1458	0,1610	0,2257	—0,0001	—	—	—	—	—	—	0,0585	0,8648	—	—	0,0001	—0,0001	0,7620	118,46[a]
	(2,2804)[b]	(3,3162)[a]	(5,9563)[a]	—(0,9503)							(0,3405)	(0,8435)			(5,9395)[a]	—(4,9060)[a]		
17	24,3150	0,1623	0,2094	—0,0001	—	—	—	0,1872	—	—	—	—	0,0188	—	0,0001	—0,0001	0,7801	131,24[a]
	(1,8197)[c]	(3,8308)[a]	(5,4699)[a]	—(1,0523)				(4,7294)[a]					(0,5683)		(4,1875)[a]	—(4,1853)[a]		
18	41,5272	0,1594	0,2459	—0,0001	—	—	—	—	—	—	—	—	—	—	0,0001	—0,0001	0,7615	138,34[a]
	(2,6846)[a]	(3,5796)[a]	(6,3248)[a]	—(0,9207)											(6,7509)[a]	—(5,7096)[a]		
19	28,2125	0,0656	0,1591	—0,0001	—	—	—	—	—	—	—	—	—	0,2948	0,0001	—0,0001	0,8133	181,18[a]
	(2,0445)[b]	(1,5059)[c]	(4,4263)[a]	—(2,1605)[b]										(8,4781)[a]	(6,0849)[a]	—(4,8305)[a]		
20	37,7017	0,1623	0,2318	—0,0001	—	—	—	—	—	—	—	—	—	—	0,0001	—0,0001	0,7616	137,85[a]
	(2,4626)[a]	(3,6549)[a]	(6,1467)[a]	—(1,0366)											(6,7066)[a]	—(5,5422)[a]		

OBS.: Letters *a*, *b* and *c* indicate that the coefficients of regression are statistically significant at the levels of 1, 5 and 10%, respectively. The values in parenthesis are the Student *t* statistics and, in the case of the polinomial expressions, partial *F* statistics. We have used unilateral tests, since the expected relationship between TRV_{ij} and each of the independent variables is perfectly clear.

giving the predicted sign, was not significant, which might suggest a certain homogeneity, or else a limited relevance of earnings from these investments.

Finally, the measure used as a proxy for export incentives (IFX_{ij}) was also statistically null. This finding may indicate that export incentives generally compensate only the highest internal costs, at a production level too low to allow for economies of scale. Nor do there appear to be adjustment or information access rigidities causing earnings to be differentiated between exporting and non-exporting firms.

As in the preceeding discussion of heteroscedasticity, the *OLS* estimators in Table 6 are not efficient, as revealed by application of the Quandt-Goldfield test. [88] The solution here was to use a system of empirically determined weights, as suggested by Hall and Weiss. These authors plotted the sum of the squares of the residuals against the medians of successive groups of firms classified by size, and observed and adjustment pattern approximatelly proportional to the inverse of this variable. [89]

Under these circumstances, the pre-multiplication of the amplified matrix [*Y X*] by the weight matrix [*P*], made up of the standard deviations of the residuals of each observation — which is the form used when applying the method of weighted least squares method — is equivalent to multiplying each line by the square root of size. [90]

The main findings incorporating these corrections are summarized in Table 7. [91] As expected, the model's explanatory powers increase substantially, as is visible in the new values taken by statistics t and F and by the coefficient R^2.

With some exceptions, the variables' signs are the same as shown in the previous table, but their significance is improved. This occurs with PMR_{ij}, DPA_{ij}, TAA_{ij} and LT_{ij}. Variables LV_{ij} and OK_{ij}, previously statistically null, became significant, reinforcing the weak evidence revealed by the earlier regressions.

The most notable changes were in relation to variables $CDIP_{ij}$ and CDR_{ij}, which changed signs. This inversion may be related to

88 See Johnston (1972, pp. 218-9).

89 Repetition of this exercise with the data from the sample revealed a type of adjustment similar to that obtained by Hall and Weiss.

90 Hall and Weiss (1965, pp. 323-4); see also Theil (1971, pp. 244-5). Strictly speaking, this correction also implies multiplying the column of 1 in matrix [*X*] and, in this case, the regressions will not include the constant term, which is replaced by the coefficient of the variable used for weight. In practice, however, only the explanatory variables were weighted, which eliminates any problem in the interpretation of the constant term.

91 Application of the Quandt-Goldfield test to the corrected data revealed no further heteroscedasticity.

the fact that the correction increased the importance of size in the *OLS* estimation. Size is strongly correlated with the first two variables ($r = 0.63$ and 0.65, respectively).

The other variables — IK_{ij}, $IFD2_{ij}$, IFX_{ij} and $TJ2_{ij}$ — did not reveal noticeable changes.

4 — Conclusions

The empirical findings produced by the three versions of the industry model coincide in revealing a persistently positive relation between structural characteristics (represented basically by the concentration ratio) and private profit rates. Profitability differentials observed in Brazilian industry thus partially reflect the exertion of market power originating in the industry's structure.

The results also show that, despite the high degree of protection enjoyed by Brazilian industries, there is still room for foreign competition to play the indispensable role of diluting the degree of domestic concentration, thus reducing industry's ability to hold prices above medium- and long-term production costs.

In addition, economies of scale are clearly influential in achieving higher profitability rates. The supposed sensitivity of technology to each country's factor endowments notwithstanding, market size plays an important role in obtaining returns to scale.

The constantly positive relation between profitability and the rate of growth of demand suggests that, while this variable must be taken as one among several other of the model's explanatory factors, earlier evaluations based exclusively on this variable tend to reproduce the same rank of performance.

As for the basic firm-level model (equation 8), the following are the most significant findings:

1. Profitability is strongly associated with firm size, though not in a linear form. The larger firms are more profitable, but this difference diminishes as size increases.
2. Large market shares held by individual firms are also an important factor in explaining high rates of profitability.
3. The findings suggest that efforts to differentiate products are highly compensatory. Firms investing heavily in advertising are among the most profitable.
4. Weak evidence was found for the contention that foreign control of capital is associated with higher rates of profitability.
5. Controls exerted by the Interministerial Price Council (CIP) indeed seem to be limiting market power in Brazilian

industry. Firms subject to some form of price control by the CIP showed systematically lower rates of profitability.

6. Indebtedness is quite an attractive form of increasing profitability, despite the pressure of financial expenditures on costs. This is probably due to subsidized credit programs, more accessible to larger firms.

7. As for the firm's tax treatment, the results do not reveal the presence of profitability differentials associated with the subsidies implicit in incentive programs for regional or sectoral development or for manufactured exports. This suggests marginal utilization of the first type of incentive and a mere covering of the highest internal costs, in the case of the latter. With regards to export incentives in particular, there appears to be no adjustment or information access rigidity causing profitability differentials between exporting and non-exporting firms.

Some additional coments should be finally made on the implications of the main empirical finding of our analysis: the influence of market structure on private profitability.

As was suggested, market power produced by heavily concentrated structures and by large individual firm size contributes significantly to high rates of profitability, which – in this model's context – points to the existence of static allocational inefficiencies. The exertion of market power also negatively affects the distribution of income, encouraging concentration of economic and, by extension, political power. These implications, not always explicitly included in discussions on conditions affecting the country's recent industrialization process, are relevant to problems facing economic policy makers today.

In particular, the continuation of protectionist policies (tariff and non-tariff barriers to trade) must be examined in the light of these distortions. The stage of import substitution without any consideration of costs must be replaced by a less tolerant attitude toward allocational inefficiencies caused by the industrialization process over the years, and by greater concern for guaranteeing more competitive markets. This competitive marketplace could be promoted through protectionist policies more consistent with real market structures and through the establishment of specific legislation to counter monopolistic practices and defend the consumer. Such legislation would have the advantage of removing the inevitably arbitrary character of decisions regarding these problems, as long as they remain under the wings of price control policies.

Appendix

Description of the variables

Table 1

SRF[1] *Two-dgiit Level of Industrial Classification — Model 1 — Main Empirical Results*

Dependent Variables: TRV_j

Variable	Measure		Source of basic data
	Symbol	Description	Brazil, MF/SRF, IR-PJ (1974-76).
Profitability	TRV_j	Final taxable profits — taxes due, average 1973-75 / Total revenue	(Covers universe of corporate income tax payers (IR-PJ)
	TRE_j	Final taxable profits — taxes due, in 1975. / Capital + reserves	Covers universe of corporate income tax payers (IR-PJ)
Concentration ratio	$CR4_j$	Revenues of 4 largest firms in industry, 1974 / Total revenue	Brazil, MF/SRF Cadec (1974)[2]
	$CR8_j$	Revenues of 8 largest firms in industry, 1974 / Total revenue	Brazil, MF/SRF Cadec (1974)
	HH_j	$\sum_{i=1}^{20} PMA_{ij}^2$ where PMA_{ij} = market share of $i=1$ firm i, in 1974. $i = 1,\ldots,20$ (20 largest firms in the industry).	Brazil, MF/SRF Cadec (1974)
Economies of scale	PO_j	(Average value of output of largest establishments responsible for 50% of the value of total industry output) / Value of industry output	Brazil, SP/FIBGE; Industrial Census (1970)
Amount of capital required (for construction of *optimum plant*)	KR_j	(Average value of output of establishments responsible 50 % of value output) in 1970 and 1974, respectively X Total Assets / Sales	Brazil, SP/FIBGE, Industrial Census (1970); Ed. Visão (1975) (see Note 1, Table 2)
Product differentiation	DP	$\frac{DA+DT}{DG} X \frac{DG}{(RT+SE)}$, where DA = advertising expenses; DT = scientific and technological research expenses; DG = general expenses; RT = total revenue; and SE = inventory surplus, in 1974.	BraziF, MF/SRF, IR-PJ (1974-76) and Cadec (1974)
Growth of demand	CD_j	Rate of growth output, over the periods 1966-69 or 1966-72	Suzigan *et al*, (1974) p. 155
Foreign competition	CI_j	Rate of growth of imports, 1970-74 (average)	Carvalho and Haddad (1978b, p. A. 36)
	IM_j	Imports / Domestic output + imports — exports, 1967-72 (average)	Carvalho and Haddad (1978b, pp. 3-5)
	CM_j	Rate of growth of IM, 1967-72 (average)	Carvalho and Haddad (1978b, pp. 3-5)
Opportunities for export	EX_j	Exports / Domestic output, 1967-72 (average)	Carvalho and Haddad (1978b, pp. A. 18-20 and A. 27-8)
Participation of multinational companies	EM_j	Share of multinational companies, output in total output of the industry, in 1972.	Doellinger and Cavalcante (1975, p. 39); and Ness Jr. 1975, p. 57
Geographic dispersion	DG_j	$\sum_{i=1}^{5} \lvert X_i - P_i \rvert$ where: X_i = percentage of region i's output in total output of the industry in 1975; P_i = percentage of region i's population in total population; i = north, northeast, southeast, south and central west, in 1970.	Brazil, SP/FIBGE Industrial Census (1970 — 1975)
Risk index	TR_j	Standard devition of the TRV's for firms in the industry, in 1974	Editora Visão

[1]Federal revenue Departament (SRF) of the treasury Ministry (MF).

[2]The Special Listing of Taxpayers (Cadec) covers the largest corporate income tax payers. In 1974, they accounted for 2.5% of the total number of corporate income tax payers, and 75% of operating revenue.

Table 2

Industries as Classified by the Magazine Visão[1]

Variable	Measure: Symbol	Measure: Description	Source of basic data
Profitability	TRV_i	Net profits (before taxes), 1973-75 (average) / Sales (less sales taxes)	Ed. Visão (1974-76)
	TRE_i	Net profits (before taxes), 1971-75 (average) / Net equity	Ed. Visão (1972-76)
Concentration ratio	$CR4_i$	Sales of the four largest firms in the industry / Sales of the industry, in 1974	Ed. Visão (1975)
Economies of scale	FO_i^2	(Average sales of the largest firms responsible for 50% of industry sales / Sales of the industry, in 1974	Ed. Visão (1975)
Amount of capital required (for construction of *optimum plant*)	KR_i	Average total assets of above firms, in 1974	Ed. Visão (1975)
Growth of demand	CD_i	Rate of growth of sales 1973-75 (average)	Ed. Visão (1974-76)
Foreign competition	IM_i	Total entries from foreign market[3] / General total of exports[4], 1975-76 (average)	Brasil, MF/SRF, IPI-Informações Tributárias (1976-77)
Opportunities for export	EX_i	Total shipments to foreign market[5] / General total of shipments, 1975-76 (average)	Brasil, MF/SRF, IPI-Informações Tributárias (1976-77)
Participation of multinational companies	EM_i	Share of the multinational companies' sales in total industry sales, in 1974	Ed. Visão (1975); and Barnett (1973)
Geographic dispersion	DG_i	$\sum_{i=1}^{5} \lvert X_i - P_i \rvert$, where X_i = percentage of region i's sals in total sales of the industry (1975); p = percentage of region i's population in total population (1970); i = north, northeast, southeast, south and central west.	Ed. Visão, and Brasil, SP/FIBGE, Industrial Census (1970)
Risk index	TR_i	Standard deviation of the TRV's for firms in the industry, in 1974	Ed. Visão, (1975)

1 Industry, in this table, refers to all the firms covered by Ed. Visão, which accounted for 72% of all manufacturing sales in the census year (1970).

2 The data at this level of aggregation do not allow for calculation of a plant proxy. Therefore, FO represents a broader concept of economies of scale, covering not only output but also distribution and commercialization. See Sher r (1974, p. 16); and Koch (1974, p. 91).

3 Proxy for imports. Imports of products from abroad are considered togeth .r with industrial establishments for tax effects (Brazil, MF/SRF, 1977). Since the Industrial products sales tax (IPI) data are tabulated using the SRF activities cod it was necessary to regroup them into the *Visão* classification for this table. They refer to the universe of thouse filling up tax Returns.

4 Proxy for the value of total sales. The figure is overestimated since, during the period under study, firms were required to file the IPI declaration (model 2) for transfer of commodities to other establishments of the same firm.

5 Proxy for exports.

Table 3

Industries as Classified at the 4-Digit Level by the Federal Revenue Department[1]

Variable	Measure		Observations
	Symbol	Description	
	$TRV1_i$	Final taxable profits — taxes due / Operating income	Arithmetic mean of TRV's (weighted by the operating revenues of the firms operating in the industry) for the years in which the data were available (1973-75)
	$TRV2_i$	Final taxable profits — taxes due + royalties + foreign technical assistence / Operating income	
Profitability	$TRE1_i$	Final taxable profits — taxes due / Equity	Idem. (The TRE's are weigbted by net equity)
	$TRE2_i$	Final taxable profits — taxes due + + royalties + foreign technical assistance / Equity	
	$TRA1_i$	Final taxable profits — taxes due + + financial costs / Total assets	Idem. (The TRA's are weigted by tota aseets)
	$TRA2_i$	Final taxable income — taxes due + royalties + foreign technical assistance + financial costs / Total assets	
Concentration ratio	$CR4_i$	Operating income of 4 largest firms in the industry / Operating income	Source: Cadec, 1974 (see note 1, Table 1)
	$CR8_i$	Operating income of 8 largest firms in the industry / Operating income	
	HH_i	$\sum_{i=1}^{20} PMA_{ij}^2$, where PMA_{ij} = market share of firm i, in 1974; i = 1,2,. . ., 20 (20 largest firms in the industry).	
Product differentiation	$DP1_i$	Advertising expenses / Operating income	Simple arithmetic mean of the years for wich data was available (1973-75)
	$DP2_i$	Advertising expenses + comissions on sales + research and development expenses / Operating income	
Rate of growth of demand	CD_i	Rate of growth of real operating income, 1973-75	Ibid. Data deflated by *Conjuntura Econômica* industrial price indices (columns 53 to 105).
Foreign competition	IM_i	Total entries from foreign market[2], 1975-76 (average) / General total of shipments	Source: MR/SRF, IPI — *Informações tributárias*, 1975-76.
Opportunities for export	EX_i	Total shipments to foreign market[2] / General total of shipments	
Participation of multinational companies	$EM1_i$	Total of operating incomes of firms with OK > 25%[3] / Operating income	
	$EM2_i$	Total of operating incomes of firms with OK > 10% / Operating incomes	
Risk index	$TR1_i$	Standard deviation of $TRV1$ in the industry	
	$TR2_i$	Standard deviation of $TRV2$ in the industry	
Geographic dispersion	DG_i	$\sum_{i=1}^{5} \lvert X_{ij} - P_i \rvert$, where X_{ij} = percentage share of region i in the operating income of the industry in 1974; P_i = idem in total 1970 population; i = north, northeast, southeast, south, central west.	Source: IR-PJ sample and Brazil. SP/FIBE, Industrial Census (1970)

1 Unless otherwise noted, industry here refers to all the firms in the corporate taxpayers sample included in the same 4-digit classification.

2 See notes 1, 2 and 3, Table 2.

3 *OK* = percentage share of foreign capital in firm, in 1974.

Table 4

Individual Firm Level[1]

Variable	Measure		Observations
	Symbol	Description	
Profitability	$TRV1_{ij}$	Final taxable profits — taxes due + export proceeds from manufactured goods[2] / Operating incomes	Arithmetic mean for years in which the data wre available (1973-75).
	$TRV2_{ij}$	Final taxable profits — taxes due + royalties + + foreign technical assistance + export proceeds from manufactured goods / Operating incomes	
	$TRE1_{ij}$	Final taxable profits — taxes due + export proceeds from manufactured goods / Equity	
	$TRE2_{ij}$	Final taxable profits — taxes due + royalties + foreign technical assistance / Equity	
	$TRA1_{ij}$	Final taxable profits — taxes due + financial expenses + export proceeds from manufactured goods / Total assets	
	$TRA2_{ij}$	Final taxable profits — taxes due + royalties + foreign technical assistance + financial expenses + export proceeds from manufactured goods / Total assets	
Market share	PMA_{ij}	Firm's operating income / Operating income of industry (at 4-digit level)	Source: Cadec 1974. For smaller firms that are not listed in the Cadec, the PMA is an estimate based on the size distribution of firms included in the listing.
Market share	PMR_{ij}	$\frac{PMA_{ij}}{CR4_j}$	Besides the argment presented in item 3.1, the normalization by $CR4_j$ is justified to correct for possible overestimation caused by calculation of PMA.
Product differentiation	$DPA1_{ij}$	Advertising expenses / Operating income	Simple arithmetic mean of the years for which data was available (1973-75)
	$DPA2_{ij}$	Advertising expenses + commisions on sales + research and development expenses / Operating income	
	$DPR1_{ij}$	$\frac{DPA1_{ij}}{DP1_j}$	
	$DPR2_{ij}$	$\frac{DPA2_{ij}}{DP2_j}$	
Rate of growth of demand	CDA_{ij}	Rate of growth of real operating income, 1973-75	Ibid. Data deflated by *Conjuntura Econômica* prices indices for products in the industries in which the firm operates (column 53 to 105)
	CDR_{ij}	$\frac{CDA_{ij}}{CD_j}$	
Size	TAA_{ij}	Total assets	Ibid
	TAE_{ij}	Equity	
Capital intensity	IK_{ij}	Total assets / Operating income	
Financial structure	LV_{ij}	Capital liabilities / Net Equity	
	$TJ1_{ij}$	Financial expenses / Liabilities at end of preceeding fiscal year	
	$TJ2_{ij}$	Financial expenses / Operating income	

(*Continue*)

(Conclusion)

	LT_{ij}	Final taxable profits / Real profits	Simple arithmetic mean of the years for wich data was available (1973-75)
Tax treatment	$IFD1_{ij}$	Financial investment related to tax incentives / Total assets	
	$IFD2_{ij}$	Financial investment related to tax incentives / Liabilities	
	IFX_{ij}	Export proceeds from manufactured goods / Operating income	
Source of capita	OK_{ij}	Share of foreign capital in the firm, in 1974	
	DOK_{ij}	Dummy variable, which assumes value 1 if any part of the firm's capital is held by foreign partners, and zero otherwise.	
Price control	$DCIP_{ij}$	Dummy variable, which assumes value 1 if the firm is under any kind of control by *CIP*, and zero otherwise.	

1 Unless otherwise noted, the data source is the corporate taxpayers sample.

2 Export proceeds from manufactured goods were re-included in profits to account for the effect of fiscal incentives to export (see item 3.3).

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