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Chapter Author: Jose L. Carvalho, Claudio L. S. Haddad

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2 Foreign Trade Strategies and Employment in Brazil

José L. Carvalho and
Cláudio L. S. Haddad

2.1 Introduction

Brazil, along with Korea, is one of the countries included in this volume that has had experience with both import substitution and export promotion policies. Import substitution policies were followed until 1965; by 1968 policies were reversed to promote exports. The export promotion policies have been successful in many respects. For example, in the last ten years of the import substitution phase, the average annual growth rates of GDP, industrial output, and manufacturing employment were roughly 5, 6, and 2 percent respectively. After export promotion policies were introduced these rates increased dramatically. In the period 1966–75 they averaged 9, 11, and 10 percent. The manufacturing sector responded enthusiastically to the new policies. Its share in GDP rose from about 25 to 30 percent from 1966 to 1974 while the share of manufacturing exports in total exports increased from about 6 to 16 percent in the same period. From 1964 to 1974 Brazil's manufactured exports increased eighteenfold in dollar terms, or at an average annual rate of 33 percent.

José L. Carvalho and Cláudio L. S. Haddad are associated with the Escola de Pós-Graduação em Economics, Fundação Getúlio Vargas.

During the time we worked on this project, we benefited from the working parties organized by NBER and from discussions in the economic research seminar at the Graduate School of Economics (EPGE) of Getúlio Vargas Foundation (FGV), where this study was presented in fragmented form.

Although we are sure to omit names, we would like to thank Anne O. Krueger for her comments and guidance throughout the entire work; Hal Lary for his meticulous comments and editing suggestions; Arnold C. Harberger for the time he spent reading and editing parts of this work and for discussing it with us during his short, but very helpful, visits to EPGE during these past two years; Hugo Barros de Castro Faria for his assistance and for sharing with us his large experi-

Thus Brazil is a particularly appropriate case study of the relation between trade strategies and employment. Such a study is important in its own right, but, more important, it is suggestive of the potentials of export promotion and the pitfalls of import substitution policies.

Our purpose then is to analyze the employment implications of Brazil's trade policies. We are fortunate that we have data covering both phases of its trade regime and can estimate labor requirements for 1959, 1970, and 1971. It should be noted at the outset, though, that our labor requirements are not strictly comparable with those of other countries discussed in this volume. Namely, our indirect labor requirements include all manufacturing and mining industries (but not agriculture and services), whereas those for most other countries pertain to home goods, as was described in the introductory chapter. Data problems necessitated this treatment. Its implications are dealt with in more detail in section 2.3 below.

2.2 A Summary of Brazilian Economic Development

2.2.1 Growth: An Overview

Brazil is a large, prosperous, and populous developing country that has historically had relatively high rates of growth.[1] Its total area of 3,286,470 square miles makes it larger than the United States, including Alaska. Its income per capita of about U.S. $1,400 (1977) places it in the middle-income category used by the World Bank. Its population of 110 million (1976) makes it the third most populous (not centrally planned) LDC (behind India and Indonesia).

The Brazilian economy has had relatively high growth rates for nearly half a century. From 1911 to 1947 industrial production in Brazil grew at an annual average of 6.5 percent while the population was growing at 2.1 percent a year (Haddad 1974).[2] For that period a per capita indus-

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trial growth rate of about 4.4 percent a year is very impressive by international standards. After World War II, the rate of economic growth accelerated. Brazilian real GDP grew at an annual average rate of 7.1 percent; industrial output increased faster than agriculture (as is shown in table 2.1), so that the share of industry in GDP was nearly 40 percent in 1975 as opposed to 26 percent in 1949 (see table 2.2). Manufacturing makes up about 75 percent of output of the broad industrial category that also includes mining, public utilities, and construction. Manufacturing output alone increased its share of GDP from 20 to 30 percent in the period 1949–75.

2.2.2 Trade and the Brazilian Economy

Pattern and Composition of Trade

Trade has been important for Brazil, even during the import substitution trade regime. Imports and exports in the late 1950s and early 1960s each were about 8 percent of GDP. In more recent years, their combined total has been about 25 percent. About 65 percent of current exports consist of natural-resource-based (NRB) goods, of which coffee, soybeans, and iron ore are most important. However, the share of NRB goods in total exports has fallen dramatically (in 1960, it was 97 percent). As mentioned above, manufactured exports increased rapidly after export promotion began. Major manufactured exports include leather products, chemicals, textiles, clothing, and food products (see appendix tables 2.A.1 to 2.A.3). In 1976 merchandise exports totaled slightly more than U.S. $10 billion, of which manufactured exports were nearly U.S. $3 billion. Brazil's major imports are machinery and equipment with a high technological content (about 25 percent of total imports), oil (another 25 percent), nonferrous metals, coal, and wheat. Brazil produces most of the consumer durables consumed domestically. Consumer goods made up about 13 percent of total imports in the early 1970s. However, this represented a doubling of the 6 to 7 percent share of consumer goods in total imports in the late 1950s and early 1960s, when the import substitution policy was most severe.

Brazil has succeeded in diversifying the destinations of its exports, though not the sources of its imports. About 60 percent of total exports went to developed nations in 1976 compared with 80 percent in 1960. For manufactured exports, the share of developed nations fell from about 90 to 70 percent in the same period. The developed nations' share in Brazil's imports has remained fairly stable at about 75 percent in the past two decades. Major trading partners among developed countries include the United States, Germany, Japan, and the Netherlands. Among LDCs, major trading partners include fellow Latin American Free Trade Area (LAFTA) members, Argentina, Chile, Venezuela, and Mexico.

Table 2.1 **Rates of Growth of Gross Domestic Product in Brazil, 1951–74: Total, Agriculture, and Industry (Annual Percentage Change)**

Years	Total GDP	Agriculture[a]	Industry[b]
1951	6.0	0.7	6.4
1952	8.7	9.1	5.0
1953	2.5	0.2	8.7
1954	10.1	7.9	8.7
1955	6.9	7.7	10.6
1956	3.2	−2.4	6.9
1957	8.1	9.3	5.7
1958	7.7	2.0	16.2
1959	5.6	5.3	11.9
1960	9.7	4.9	5.4
1961	10.3	7.6	15.0
1962	5.3	5.5	7.8
1963	1.5	1.0	0.2
1964	2.9	1.3	5.2
1965	2.7	13.8	−4.7
1966	5.1	−3.2	11.7
1967	4.8	5.7	3.0
1968	9.3	1.4	15.5
1969	9.0	6.0	10.8
1970	9.5	5.6	11.1
1971	11.1	11.4	11.2
1972	10.4	4.5	13.8
1973	11.4	3.5	15.0
1974	9.5	8.5	8.2
	Average Annual Rate		
1952–73	7.1	4.9	8.9
1952–58	6.7	4.8	8.8
1959–64	5.9	4.3	7.6
1965–73	8.1	5.4	9.7
1968–73	10.1	5.4	12.9

Source: Fundação Getúlio Vargas, *Conjuntura Economica*, various issues. A new set of estimates for the national accounts was recently published by FGV (*Conjuntura Economica* 31 [July 1977]), but the revision was performed from 1965 on. Here we present the previous estimates.

[a]Agriculture includes fishing and forestry. The share of agriculture in GDP fell from 26.1 percent in 1953 to 14.8 percent in 1973.

[b]Industry includes, in addition to manufacturing, mining, construction, and utilities. The share of industry rose from 23.7 percent of GDP in 1953 to 31.8 percent in 1973.

Table 2.2 **Sectoral Distribution of Total Income at Factor Cost, Selected Years (Percentage)**

Year	Agri-culture	Services	Industry Total	Industry			
				Mining	Manu-factures	Public Utilities	Con-struction
1949	24.9	49.1	26.0	0.5	20.0	1.1	4.3
1959	19.2	48.2	32.6	0.5	25.0	1.4	5.6
1965	15.9	51.6	32.5	0.8	24.8	1.7	5.3
1970	10.2	53.5	36.3	0.8	27.4	2.1	6.0
1975	10.5	50.0	39.4	1.4	30.2	2.2	5.7

Source: Total income from Fundação Getúlio Vargas, *Conjuntura Economica* 31 (July 1977):95; industry income, ibid., p. 97.

Balance of Payments

Brazil has almost continuously run deficits in its current account, often because of deficits in its service account (see table 2.3). Long-term capital inflows often do not counteract the current account deficit, although they are generally fairly large (in recent years being about one-half the value of exports). Direct investment inflows make up about one-third of long-term capital inflows in a normal year. To finance balance of payments deficits, Brazil has used currency swaps and deferred import payments as well as its foreign exchanges reserves.

The Trade Regime

Brazil followed an import substitution strategy from 1945 to 1964, then reversed direction and by 1968 was vigorously promoting exports.[3]

Table 2.3 **Balance of Payments Indicators, Selected Years (Millions of U.S. Dollars)**

Indicator	1947	1952	1959	1964	1970	1975
Merchandise exports	1,157	1,416	1,282	1,430	2,739	8,493
Merchandise imports	1,027	1,702	1,210	1,294	2,507	12,042
Merchandise balance (net)	130	−288	72	344	232	−3,549
Other current account	−299	−424	−404	−263	−402	−3,540
Current account balance	−169	−710	−332	81	−561	−6,999
Long- and medium-term capital inflows	27	96	270	167	723	4,935
Balance on current account + capital account + net errors	−195	−615	− 73	55	563	−1,061
Change in reserves	−113	− 51	25	− 60	563	−1,062

Source: International Monetary Fund, *International Financial Statistics*, (various years).

The import substitution phase can be further divided into four periods with varying degrees of restrictiveness (1946–53, 1953–57, 1957–60, 1961–64).

The early phase of the import substitution period (1946–53) was characterized by a highly overvalued exchange rate. After World War II, there was a tremendous surge in imports as war restrictions were lifted. Even a large increase in coffee prices was not sufficient to equilibrate the current account. Rather than devalue the cruzeiro, the government instituted an import licensing system. A continuing fall in the real exchange rate (see table 2.4), coupled with expansionary domestic policies (which raised the rate of inflation—see table 2.5) and a stabilization of coffee prices, led to a trade deficit of nearly U.S. $300 million in 1952 and an overall deficit of U.S. $615 million. This deficit led to the adoption of a multiple exchange rate system in 1953.

Under this system, foreign exchange available for imports was divided into five categories and auctioned off. In general the exchange rate system and other incentives laid a basis for import substitution of finished consumer goods and food products. The most-preferred import category was chemicals and capital equipment. Its nominal exchange rate was usually one-third that for the least-favored finished consumer goods import category. On the other hand, exports were clearly discouraged, with the noncoffee rate being well below all import rates.

In 1957 the auction system was modified. The number of import categories was reduced to three, but in general rates for the most-preferred imports were again about one-third of those for the least-preferred imports. At this time a system of ad valorem tariffs was introduced. It too was cascaded; nominal rates varied from 60 to 150 percent for products available from domestic sources and from 0 to 10 percent for products not produced domestically. In addition, the Law of Similars was activated. This law prohibited imports of products available from domestic sources. However, Fishlow (1975, p. 29) concluded that the Law of Similars did not impose significant quantitative restrictions on imports, probably because it was redundant, given all the other import restrictions.

The end of the import substitution phase (1961–64) was a difficult one for the Brazilian economy. The "industrialization at any cost" program of the late 1950s coupled with ambitious government projects generated large budget deficits that were mainly financed through increases in the money supply. (The money supply increased by nearly 500 percent from 1961 to 1964.) Inflation worsened (see table 2.5); at their worst in 1964–65, prices were rising at an annual rate exceeding 80 percent.

In 1961 the multiple rate system was eliminated, the currency was devalued by 40 percent (followed by devaluations of close to 50 percent

in 1962 and 1963 and more than 100 percent in 1964). But these devaluations did little more than counteract inflation. Finally, in 1964, after a military takeover, policies were abruptly changed.

Table 2.4 **Nominal and Real Exchange Rates, 1946–74**

Year	Nominal Export Rate[a] (Old Cruzeiros/ U.S. Dollars)	Real Export Rate Index (1951 = 100)
1946	19.6	108.8
1947	18.7	116.4
1948	18.7	117.3
1949	18.7	107.3
1950	18.7	108.8
1951	18.7	100.0
1952	18.7	86.4
1953	28.4	n.a.
1954	36.3	n.a.
1955	43.0	100.7
1956	50.0	109.6
1957	53.0	77.3
1958	65.4	117.1
1959	114.0	143.2
1960	160.0	152.6
1961	268.0	182.0
1962	390.0	176.3
1963	575.0	148.1
1964	1,284.0	181.8
1965	1,900.0	178.3
1966	2,220.0	152.5
1967	2,660.0	145.3
1968	3,390.0	154.0
1969	4,070.0	161.6
1970	4,590.0	158.2
1971	5,290.0	154.7
1972	5,930.0	154.0
1973	6,130.0	156.0
1974	6,790.0	159.4

Source: Fishlow (1975) for nominal rates; real rates are the product of nominal rates multiplied by the ratio of United States wholesale prices to Brazilian wholesale prices. See Carvalho and Haddad (1978, chap. 2) for details. This has been called the purchasing power parity adjusted nominal exchange rate (PPP-NER) (see chap. 1 of this volume).

[a]For noncoffee exports during years of multiple exchange rates.

In summary, the import substitution phase was characterized by increasingly severe restrictions on imports. The major policy instrument was a cascaded multiple exchange rate system favoring domestic pro-

Table 2.5 Inflation Rates in Brazil, 1951–74 (Annual Percentage Change)

Years	General Price Index[a] (1)	Wholesale Price Index[a] (2)	Consumer Price Index[b] (3)	Implicit Price Deflator (4)
1951	16.5	17.4	10.8	12.0
1952	11.8	9.4	20.4	13.2
1953	14.8	25.0	17.6	15.3
1954	27.0	22.3	25.6	21.4
1955	16.4	15.9	18.9	16.8
1956	19.9	26.2	21.8	23.2
1957	14.2	3.8	13.4	13.2
1958	13.0	35.1	17.3	11.1
1959	37.8	36.0	51.9	29.2
1960	29.2	34.5	23.8	26.3
1961	37.0	53.2	42.9	33.3
1962	51.6	45.5	55.8	54.8
1963	75.4	83.2	80.2	78.0
1964	90.5	84.5	86.6	87.8
1965	56.8	31.4	45.5	55.4
1966	38.0	42.1	41.2	38.8
1967	28.3	21.2	24.1	27.1
1968	24.2	24.8	24.5	27.8
1969	20.8	18.7	24.3	22.3
1970	19.8	18.7	20.9	19.8
1971	20.4	21.3	18.1	20.4
1972	17.0	16.1	14.0	17.0
1973	15.1	15.0	13.7	15.5
1974	28.7	35.2	33.7	34.0
	Annual Average Rate			
1952–73	30.9	31.1	32.9	30.4
1952–58	16.7	19.7	19.3	16.3
1959–64	53.6	56.2	56.9	51.6
1965–73	26.7	23.3	25.1	27.1
1968–73	19.6	19.2	19.3	20.5

Source: Fundação Getúlio Vargas, *Conjuntura Economica* (various issues).
Note: The changes in cols. 1 and 4 are measured from annual averages, those in cols. 2 and 3 from December to December.

[a]The general price index is a weighted average of the wholesale price index (0.6), consumer price index (0.3), and construction cost index (0.1).

[b]Consumer price index in Rio de Janeiro City.

duction of finished consumer goods. Exports were discouraged at the same time, since the export rate was always below the import rate.

After 1964, exchange premiums and advance deposits were eliminated or reduced, tariffs were lowered (1967), and a crawling-peg system was adopted (1968). More important, specific incentives, such as rebates of domestic taxes and direct subsidies in some cases, were introduced to encourage exports. The effects of these changes are evident in the growth rates of manufacturing output, employment, and exports presented earlier. The major export promotion instruments will be analyzed in greater detail in section 2.3.

2.2.3 The Structure of the Manufacturing Sector

The export promotion strategy of the late 1960s transformed Brazil's manufacturing sector. The size of the manufacturing sector grew relative to other economic activities, and manufactured exports that formed less than 1 percent of the value of manufactured output rose to more than 3 percent in 1970. The structure of manufacturing activity also changed. Notable have been increases in the relative share of basic industries such as iron and steel, machinery, and transportation equipment. Their share in manufacturing output and employment rose from 29 to 35 percent and from 30 to 37 percent respectively from 1959–70 (see table 2.6). In 1959, exports of these industries formed less than 3 percent of manufactured exports, in 1970 their combined share was more than 40 percent. On the other hand, there have been decreases in the relative shares in output of textiles and clothing and food products. Most other activities have experienced no changes in their relative roles.

2.2.4 The Labor Market

Brazil's population and labor force growth rates are high, even in contrast with those of most other developing countries. The population growth rate has remained stable at 2.9 percent, both during the 1960s and for the five-year interval from 1970 to 1975. This rate was almost exactly equal to the growth rate of the labor force over the same period, although the urban population rose considerably more rapidly, at a rate of 5 percent per annum in the 1960s and at 4.5 percent from 1970 to 1975. Nonetheless, the fraction of the labor force engaged in agriculture remains high and was still 46 percent in 1975. Thus Brazil's urban labor force will grow rapidly for years to come, as urban in-migration and the rapidly growing population both contribute to its increase.

Brazil's experience with employment and real wage rates has been marked by as sharp a contrast as have her trade policies. Tables 2.7 and 2.8 give the data on wages, employment, and changes in employment and output. From the late 1950s until the late 1960s, manufacturing

Table 2.6 **The Structure of Employment, Production, and Trade in the Brazilian Manufacturing Sector, 1959 and 1970**

Manufacturing Sector	% of Total Mfg. Employment		% of Total Mfg. Production		% of Total Mfg. Exports		% of Total Mfg. Imports	
	1959	1970	1959	1970	1959	1970	1959	1970
Nonmetallic minerals	9	8	4	4	*	2	1	1
Metal products	11	11	11	12	*	21	13	9
Machinery	3	7	3	5	1	11	22	11
Electrical equipment	3	5	4	5	*	3	6	5
Transportation equipment	4	6	7	9	1	4	21	7
Wood products	5	5	2	2	2	5	*	*
Furniture	4	4	2	2	*	*	*	*
Paper products	3	3	3	3	*	1	5	1
Rubber products	1	3	3	2	*	1	*	*
Leather and hides	1	1	1	1	4	3	*	*
Chemicals	4	1	10	12	35	20	25	12
Pharmaceuticals	1	4	2	3	*	1	1	1
Perfumery	1	1	2	2	3	2	*	*
Plastics	1	2	1	2	*	*	*	*
Textiles	21	15	13	10	2	6	*	1
Clothing and footwear	6	7	3	3	*	2	*	*
Food	14	13	21	19	50	15	3	2
Beverages	2	2	2	2	*	*	*	*
Tobacco	1	1	1	1	*	*	*	*
Printing and publishing	3	3	2	2	*	*	*	*
Miscellaneous	2	2	1	1	*	1	2	2

Source: Carvalho and Haddad (1978).
*Less than 0.5%; values may not add to 100 because of rounding.

employment growth was very slow: an index of manufacturing employment, with 1970 equal to 100, stood at 60.3 in 1955 and at 73.1 in 1965, indicating a growth rate of less than 2 percent per annum over that decade. Growth was slow despite the rapid growth of manufacturing output, which averaged 9.1 percent annually in the 1950s, 3.7 percent annually between 1960 and 1965, and 10.3 percent annually from 1965 to 1970. From 1965 to 1968, manufacturing employment rose only marginally faster, but thereafter growth was considerably more rapid: from 78.6 in 1968, the index of manufacturing employment rose to 100 in 1970 and 133.7 in 1975.

In 1959–70, manufacturing real output and manufacturing employment grew by 105 and 51 percent respectively, implying an average man-

ufacturing employment-output elasticity of about 0.5 (see table 2.8). No pattern in elasticities is discernible between faster- and slower-growing industries. Output of eleven industries grew more than 105 percent over the period. Of those eleven, six had employment-output elasticities above the average; five had lower employment elasticities. The ten slower-growing industries were evenly split between those with above- and below-average employment elasticities.

Parallel with the increase in employment growth after the export promotion strategy was introduced, there was a marked change in regulations governing employment in Brazil. In earlier years there had been a fairly high minimum wage (see table 2.7) that affected a significant fraction of the urban labor force. In the 1960s, however, the nominal minimum wage was not increased in pace with the price level, so that the real minimum wage fell, until it was constant in the late 1960s at a significantly lower level than earlier. As will be seen below in section 2.4, the fraction of the labor force covered by the minimum wage fell con-

Table 2.7 Labor Market Conditions in Brazil, 1955–74

Year	Population (Millions) (1)	Manufacturing Employment (1970 = 100) (2)	Real Wage in Manufacturing (1963 = 100) (3)	Real Minimum Wage, Rio de Janeiro (1974 Cruzeiros) (4)
1955	60.2	60.3	91.1	629
1956	62.0	60.0	98.2	657
1957	63.1	56.2	105.6	—
1958	65.8	60.8	106.2	—
1959	67.8	66.1	99.2	701
1960	69.8	n.a.	n.a.	658
1961	71.8	64.0	104.6	666
1962	73.9	73.8	100.0	—
1963	76.0	73.4	114.2	608
1964	78.2	77.4	116.8	581
1965	80.5	73.1	118.2	480
1966	82.8	72.7	118.4	440
1967	85.2	73.2	121.6	406
1968	87.6	78.6	126.9	416
1969	90.2	78.5	139.1	394
1970	92.8	100.0	139.1	385
1971	95.4	88.7	150.8	382
1972	98.2	95.1	153.4	388
1973	101.0	125.4	155.0	397
1974	n.a.	133.7	162.8	377

Sources: Col. 1: Fundação Getúlio Vargas, *Conjuntura Economica*, 1973; cols. 2 and 4: Carvalho and Haddad (1978).

Table 2.8 **Percentage Increases in Real Output and Employment and Employment-Output Elasticities, 1959–70**

Manufacturing Sector	Percentage Changes		Employment Output Elasticity
	Employment	Real Output[a]	
Nonmetallic minerals	30	89	.34
Metal products	52	133	.39
Machinery	211	292	.72
Electrical equipment	121	249	.48
Transportation equipment	119	136	.88
Wood products	48	89	.54
Furniture	54	107	.50
Paper products	66	60	1.11
Rubber products	80	31	2.62
Leather and hides	9	24	.35
Chemicals	47	138	.34
Pharmaceuticals	56	289	.19
Perfumery	44	86	.51
Plastics	385	379	1.02
Textiles	5	29	.18
Clothing and footwear	69	115	.60
Food	38	87	.44
Beverages	37	60	.62
Tobacco	15	67	.23
Printing and publishing	62	123	.50
Miscellaneous	66	150	.44
Total	51	105	.49

Source: Calculated from data in Carvalho and Haddad (1978).
[a]Real output obtained by deflating nominal values by the wholesale price index.

siderably in the face of this decline and constancy. It therefore seems evident that the considerably more rapid rate of expansion of employment in the manufacturing sector occurred at the same time when the minimum wage was becoming less restrictive. This is not to state, however, that there were no remaining labor market distortions in Brazil. On the contrary, there were a social security tax (which amounted to 20–30 percent of direct wage payments by the late 1960s), fairly severe restrictions on wages to be paid for second- and third-shift workers, and a fairly strict set of conditions under which employees could be laid off or dismissed from their jobs. Moreover, funds were available for the purchase of capital goods, which tended to induce the choice of more capital-intensive techniques than might otherwise have been chosen. The effects of these factors upon employment and the consequences of trade strategy for it are covered later in this chapter.

2.3 The Brazilian Trade Regime

This section has the dual purpose of presenting estimates of effective rates of protection covering the period 1958 to 1967 and determining the extent of subsidization of given exports in the export promotion phase.

2.3.1 Effective Protection Estimates

There are three major effective protection studies for Brazil: Bergsmann (1970, 1975) and Fishlow (1975). We have reproduced Fishlow's estimates only in table 2.9 below. These are based upon price comparisons and use the so-called Balassa method. They thus correct for redundancy in activities where there are few if any imports. Fishlow observed that domestic prices were typically lower than those implied by the tariff plus the premium implied by other trade restrictions. This was especially true for the highly protected consumer nondurables and durables but less so for intermediate and capital goods (Fishlow 1975, pp. 48–50). The estimates given below are not grouped according to trade category (exportable, importable, etc.) as suggested in chatper 1 because there were so few manufactured exports in the late 1950s and early 1960s and because the high degree of aggregation of each activity meant that both imports and exports could be significant within a category. Interpretation of ERPs would be difficult in such a case.[4] This point is further discussed in section 2.4.

Several points are illustrated in table 2.9. First, observe the sharp increase in protection from 1958 to 1963. Rates went up in all activities; the general average more than doubled, while that for manufactures rose by 75 percent. Then, after the inauguration of the export promotion policy, protection fell precipitously. In 1967 protection given the manufacturing sector was approximately 50 percent less than it was in 1958. However, manufacturing ERPs were still high despite the reduction, and the range was wide (8 percent for printing and publishing to 182 percent for rubber products).

The "cascaded" nature of protection is well reflected in the averages for consumer, intermediate, and capital goods. Until 1966 there was a clear distinction among the groups, rates being very high for consumer goods and much lower for intermediate and capital goods. In 1966 and 1967 the rates for capital goods were higher than those for intermediate goods, although this may be because some consumer durables were included in the "capital goods" group. The cascade effect is reinforced when one notes that raw materials and agricultural products were imported with zero or very low tariffs.

The cascade structure was reduced in relative terms after 1963. In 1958 the average rate for consumer goods was almost five times that for

capital goods; by 1963 this ratio was reduced to about three, and by 1967 to either two or 1.25, depending upon the choice of estimate. Since one of the main causes of distortions from protection comes from variation among the rates, we can infer from table 2.9 that the tariff

Table 2.9 **Effective Rates of Protection in Brazil (Percentage)**

Sector	1958[a]	1963[a]	1966[a]	1967[a]	1967[b]
Primary vegetable products	−47	−15	−13	−14	−14
Primary animal products	24	12	16	18	—
Mining	− 5	34	24	13	9
Manufacturing (average)[d]	106	184	108 (106)	63 (61)	48
Nonmetallic minerals	73	103	72	45	48
Metal products	61	124	63	35	33
Machinery	22	68	30	32	31
Electrical equipment	83	169	112	67	57
Transportation equipment	82	147	103	64	81
Wood products	138 (105)	176 (169)	120 (112)	81 (72)	44
Furniture	221	367	251	90	92
Paper products	86	169	91	43	42
Rubber products	139 (114)	221 (215)	158 (152)	126 (119)	182
Leather and hides	248	405	174	127	84
Chemicals	56	146	56	29	20
Pharmaceuticals	17	60	1	10	10
Perfumery	279	453	281	121	70
Plastics	281	489	332	133	117
Textiles	239 (210)	298 (291)	232 (224)	162 (154)	88
Clothing	264	481	321	107	154
Food	502 (387)	687 (652)	423 (394)	252 (218)	71
Beverages	171	243	183	104	76
Tobacco	273 (252)	469 (464)	299 (293)	114 (108)	79
Printing and publishing	139	305	142	4	8
Miscellaneous	88	175	95	47	45
General average, all sectors[d]	30 (26)	75 (74)	44 (43)	24 (23)	14
Manufacturing industry by economic groups[d]					
Consumer goods	242 (211)	360 (352)	230 (222)	122 (113)	66
Intermediate goods	65 (63)	131 (130)	68 (67)	40 (40)	39
Capital goods[c]	53	113	69	56	52

Source: Fishlow (1975, p. 58*a*).

[a]Computed with input-output coefficients from the 1959 matrix deflated by 1959 tariffs. The numbers in parentheses were obtained under the hypothesis that the agricultural inputs were not taxed.

[b]Computed with input-output coefficients from the 1971 matrix deflated by 1967 tariffs. All totals and subtotals were weighted by the structure of value added in 1959 adjusted for tariffs, with vegetable products assumed to have zero taxes.

[c]Includes some consumer durables.

[d]Averages are weighted by 1959 value added.

structure became much less distorted after 1966. Not only was the average level of protection substantially reduced, but the tariff structure also became much more homogeneous.

2.3.2 Price Differentials between Domestic and Foreign Markets

Brazil's export promotion strategy was based on three main instruments: the import liberalization measures of 1966 and 1967, the mini-devaluation (crawling-peg) policy, and fiscal incentives. Here we analyze and quantify the fiscal instruments used to stimulate exports. These fiscal incentives are tax exemptions, subsidies, and various other benefits of a more general nature.[5] We will show that these instruments allow domestic producers to sell in world markets at prices some 40 percent below what they would receive in domestic markets. The most important fiscal incentives are related to two Brazilian taxes: the IPI (tax on industrialized products) and the ICM (tax on the turnover of merchandise).[6] The IPI is a federal tax applied to all industrial products. The IPI tax rates vary among products according to their "essentiality." Thus cigarettes, alcoholic beverages, and cars are, on average, heavily taxed, while foodstuffs are subject to the lowest rate. The ICM is a state tax applied to all traded products. A single rate applies within each state, although it varies from state to state.[7]

Tax exemptions for exports include both (*a*) rebates of IPI tax by Law 4502 (1964) and regulated by Decree-Law 6514 (1967); and (*b*) a drawback of ICM tax on manufactured products (constitution of 1967 and Decree-Law 406 [1968]). Pressed by the federal government, some states have extended the rebates to primary products exported as well.

Subsidies to encourage exports include a tax credit premium and low interest rates on loans related to export activities. IPI tax credits are given up to the limit of 15 percent of value added. In some cases, depending on the state, a similar tax credit is given for the ICM tax. When given, the ICM credit rate is equal to the IPI rate up to the limit of 13 percent of value added. These tax credits are granted against exports of manufactures and can be used to pay other IPI or ICM debts. Eventually, any positive balance remaining in favor of the firm can be paid in cruzeiros by the government (federal or state). If the drawback of tariffs on imported inputs is used, tax credits are applied to the exporting price net of the imported inputs. The firm has the option of deciding to take the drawback or applying these tax subsidies to the full exporting price.

Credit incentives take the form of subsidized interest rates for loans linked to exporting activities. Some industries benefit from existing programs under which loans are awarded under very special conditions. The principal source of subsidy to the exporting sector via credit was

Resolucão 71 (1967) of the Central Bank.[8] Under Resolucão 71, commercial banks that operate with foreign currencies can obtain resources from the discount window at low rates (4 percent a year) as long as they are lending to the export sector. The exporting firm obtains from CACEX[9] a certificate that the firm will export (Certificado de Habilitacão). With this certificate the firm can borrow up to 80 percent of the export value for 120 days at an interest rate of 8 percent a year. Credit can be obtained under these same conditions based on previous exports for which no borrowing was undertaken earlier.

In Appendix B, we have derived expressions that incorporate the effects of these fiscal incentives upon exporters' prices in the domestic market and the world market. Table 2.10 summarizes results under four sets of assumptions concerning tax rates and credits and subsidized credit. The top half of table 2.10 gives these assumed values for the various elements of the expressions in Appendix B. The differences

Table 2.10 **Subsidies to Exports of Industrial Goods in Brazil under Different Hypotheses**

	Cases			
Parameters	1	2	3	4
ICM tax rate applied to the internal supply price	0.13	0.13	0.13	0.13
IPI tax rate applied to the internal supply price	0.08	0.10	0.10	0.15
Income tax rate	0.225	0.225	0.225	0.225
Tariff rate on imported inputs	0.25	0.25	0.25	0.25
Market interest rate minus interest rate given on loans to export activities	0.08	0.08	0.08	0.14
ICM tax premium	0.08	0.10	0.10	0.13
IPI tax premium	0.08	0.10	0.10	0.15
Sum of ICM and IPI tax premiums	0.16	0.20	0.20	0.28
Profits per unit of output as a fraction of the foreign price	0.10	0.10	0.10	0.16
Imported input content	0.20	0.20	0.30	0.20
Loans to export activities per unit of output (as a fraction of the foreign price)	0.50	0.50	0.50	0.65
Ratio, world to domestic price	0.6331	0.6057	0.6026	0.5047
Ratio, simplified version[a] world to domestic price	0.6944	0.6591	0.6591	0.5910
Ratio, world to internal supply price[b]	0.6837	0.6662	0.6629	0.5804
Subsidy as a percentage of the internal supply price	14.63	16.30	14.71	28.95

[a]The simplified version (see eq. A6, App. B) includes only the effects of ICM and IPI tax credits and rebates.

[b]The internal supply price does not include the IPI but includes the ICM on inputs.

among the cases are: case 2 has a higher IPI tax rate (10 percent) than case 1; case 3 has a higher imported input content (30 percent) than case 2; case 4 has the same imported input content as cases 1 and 2 but has a greater amount of special program loans than cases 1–3; case 4 also has a higher IPI tax rate, obtains a higher credit subsidy, and has higher ICM and IPI tax credits than cases 1–3.

Reasons for the choice of values in each case are as follows: (1) the 13 percent ICM tax rate is the current rate; (2) the 8–15 percent rates are the typical range for the IPI tax; (3) the legal income tax rate is 30 percent, but a deduction of 25 percent (of the 30 percent, or 7.5 percent) is allowed if firms engage in special export programs; (4) the interest rate differential is arbitrarily assumed to be 8 or 14 percent; and (5) other values are arbitrary choices.

Under the various assumptions, exporters can sell in world markets at prices about 50 to 60 percent of those in domestic markets. The subsidy is in the range of 15 to 30 percent of the internal supply price.[10] It must be emphasized here that these subsidies apply mainly to exports of industrial goods. Most of the exports of agricultural goods are still taxed. Occasionally the taxation is direct either in terms of tariffs or in terms of export quotas. In other cases it is indirect, since no rebate of ICM paid is granted to exports in a number of important cases like coffee and soybeans.

2.3.3 Summary

Levels of protection on domestic production fell markedly and became more homogeneous after the introduction of the export promotion strategy in the mid-1960s. In 1967 average ERPs on manufactures were in the neighborhood of 50 percent while average ERPs on consumer goods were some 50 to 100 percent higher than those for intermediate and capital goods. In the import substitution phase, ERPs on consumer goods were approximately four times those on capital and intermediate goods. As in most LDCs, manufacturing activity is more protected than NRB production. In Brazil, nonanimal primary products faced negative effective protection.

The export promotion strategy has used tax exemptions and subsidies and preferential credit facilities to encourage manufactured exports. The total subsidy from these measures was found to range from 15 to 30 percent under various assumptions about the extent of the various individual subsidy elements.

2.4 Trade and Employment in Brazil

In this section we calculate the labor content of Brazilian tradable activities. Our focus is limited to manufacturing activities mainly to avoid

problems stemming from the availability of natural resources. Given Brazil's factor endowment, our a priori expectations are that Brazil's manufactured exports will be more labor-intensive than her import-competing manufactures. Furthermore, if human capital and physical capital are complementary factors of production, then manufactured exports will be relatively less skill-intensive than Brazilian import substitutes. Labor intensities will be examined first, and skill intensities will be analyzed later in the section.

2.4.1 Labor Requirements

Total direct and indirect labor requirements used in producing exportables and importables can be estimated from the input-output matrixes available for Brazilian economy for the years 1959, 1970, and 1971.[11] In principle, labor requirements should be computed per unit of value added in any given sector. The input-output matrixes presented input coefficients with respect to value of production, however, and so we first computed labor requirements on this basis, then derived estimates per unit of value added more indirectly.

The matrixes for 1959 and 1971 were aggregated into twenty-five sectors, of which twenty-one were manufacturing activities and the others were mining, construction, agriculture, and services. The 1970 matrix was more highly disaggregated than those for 1959 and 1971 but covered only mining and manufacturing sectors. The matrix contained fifty-eight activities, of which two were mining and fifty-six were manufacturing activities. We first present our labor estimates derived from the relatively aggregative 1959 and 1971 I-0 (input-output) tables, then give results computed from the more detailed 1970 table. It should be noted that the 1959 and 1971 estimates relate to all exports and all imports of manufactures. That is, we do not classify activities as importables and exportables, then calculate weighted averages of labor coefficients of activities in each category. Rather, we calculate labor coefficients for exportables and importables using exports and imports in all categories as weights. The reason for this procedure is the high degree of aggregation in these tables. In many cases there were significant exports and imports in each activity (see appendix tables 2.A.1 and 2.A.2). This made interpretation of trade categories ambiguous. However, the 1970 I-0 table was disaggregated to the extent that categorization of activities was possible. In that case we present estimates of labor requirements corresponding more closely to the trade categories defined by the T statistic outlined in the chapter 1 of this volume.

Estimates for 1959 and 1971

To obtain direct and indirect labor requirements per unit of exports and of import substitutes, we used the following procedure. First we

derived trade weights from the percentage distribution of 1959 and 1971 exports and imports among the twenty-one manufacturing sectors. Next we computed direct labor inputs, in man-years, per million cruzeiros of value of production for each manufacturing activity. These coefficients were derived from the 1960 and 1970 censuses. The census of 1960 gave values for 1959 expressed in prices of that year. The 1970 census values were assumed to be valid for 1971 once they were adjusted to 1970 prices. After computing direct labor requirements for each sector per unit of value of production, we next derived indirect requirements. This was done by applying the direct labor coefficients for 1959 and 1970 to the commodity inputs (both direct and indirect) from each of the twenty-one sectors into each other sector, as given by the input-output matrixes for 1959 and 1971. The procedure just outlined gave labor requirements, direct and indirect separately, for 1959 in terms of value of production at prices of that year and for 1971 in terms of value of production at 1970 prices. The coefficients for 1959 were deflated by the increase in prices between that year and 1970 to allow a meaningful comparison of the two vectors as given in tables 2.11 and 2.12.

The vectors of labor requirements per unit of value added, also shown in tables 2.11 and 2.12, were computed as follows. First we calculated value added by deducting transportation, advertising, and other expenses not related to payments to labor or capital from the value of "industrial transformation" (defined as the value of production minus the value of intermediate products). Second, we computed direct labor requirements per unit of value added (increasing the ratio of labor to value of production by the ratio of the latter to value added). We then computed indirect labor per unit of value added in each sector, such indirect labor being the sum of direct and indirect labor incorporated in inputs from all other sectors. Finally we added the direct and indirect labor requirements to obtain the ratio of total labor to value added for each of the twenty-one manufacturing activities.[12] In contrast to the method outlined in chapter 1, this procedure relates direct and indirect labor requirements to direct value added rather than to direct plus indirect value added. That is the reason for the differences between direct and total (direct plus indirect) labor coefficients given in tables 2.11 and 2.12.[13]

The results given in tables 2.11 and 2.12 indicate the wide range of labor requirements in manufacturing. In 1959 the most labor-using industry (in terms of value-added measures) was clothing. Other labor-intensive industries were wood products, furniture, nonmetallic minerals, textiles, publishing, and leather. The same pattern occurred in 1971, with clothing being the second most labor-using industry behind wood products. The other labor-intensive industries in 1959 generally remained labor-intensive in 1971.

Table 2.11 **Direct and Indirect Labor Requirements in Manufacturing, 1959 (Man-Years per One Million 1970 Cruzeiros of Value of Production or of Value Added)**

	Value of Production			Value Added		
Manufacturing Sector	Direct	Indirect	Total	Direct	Indirect	Total
Nonmetallic minerals	46.17	12.12	58.29	144.60	30.03	174.64
Metal products	31.36	22.57	53.93	87.58	58.71	146.30
Machinery	41.30	23.31	64.61	102.63	62.53	165.16
Electrical equipment	27.58	28.05	55.63	85.17	76.30	161.47
Transportation equipment	22.84	24.21	47.05	72.34	67.40	139.75
Wood products	62.89	14.31	77.20	157.23	36.31	193.55
Furniture	65.33	28.47	93.80	159.53	74.64	234.18
Paper products	26.06	22.57	48.63	87.63	70.20	157.83
Rubber products	15.64	12.05	27.69	39.22	33.23	72.45
Leather and hides	43.27	17.12	60.39	129.40	47.87	177.28
Chemicals	16.16	23.47	39.63	47.15	49.23	96.39
Pharmaceuticals	26.26	13.03	39.29	80.46	32.80	113.26
Perfumery	18.13	17.97	36.10	72.39	44.63	117.02
Plastics	27.09	19.38	46.47	68.83	50.51	119.34
Textiles	49.57	22.80	72.37	150.34	65.82	216.16
Clothing and footwear	54.38	57.03	111.41	155.57	156.38	311.96
Food	20.87	6.58	27.45	99.05	22.48	121.53
Beverages	35.09	8.98	44.07	95.88	29.43	125.31
Tobacco	22.35	3.82	26.17	52.18	10.98	63.16
Printing and publishing	50.25	19.72	69.98	120.69	60.85	181.54
Miscellaneous	55.47	15.69	71.16	126.18	41.79	167.98

Source: Census of 1960 and input-output matrix for 1959. The relative price level used for 1959 over 1970 is 0.02235.

Before going further we need to mention two qualifications, rather opposite in nature, with respect to the methods employed in computing indirect labor requirements. One is that, because of limitations imposed by the available input-output matrixes, the estimates refer only to employment in manufacturing and mining. The omission of indirect employment in agriculture results in an understatement of total employment generated by manufacturing and by exports in particular.[14] This omission is not necessarily bad, since agriculture is an NRB tradable category that should have been omitted if we were able to calculate indirect employment following the procedure outlined in chapter 1. The second qualification is that the procedure we have followed in estimating indirect labor inputs implicitly assumes that all industrial inputs are, or can be, domestically supplied.[15] Indeed, the assumption is that all inputs are nontradables (like "home goods" as specified in the introductory chapter of this volume for purposes of estimating indirect inputs). This qualifi-

cation biases our direct plus indirect estimates upward. The net effect of these qualifications is that the employment coefficients reported here may be too low or too high, depending on the relative weight assigned to these two qualifications.

Having determined the vectors of total labor requirements across manufacturing, the next step was to apply them to the vectors of exports and imports for 1959 and 1971 (see appendix tables 2.A.1 and 2.A.2), to obtain average labor coefficients generated by an increase of one million cruzeiros of exportables or importables.[16] We used both value added and value of production in these calculations. Both are reported in tables 2.13 and 2.14.

In 1959 importable manufactures were more labor-intensive than exportables. On the other hand, the reverse is true in 1971. The 1959 relationship reflects the fact that exports of manufactured goods in 1959

Table 2.12 **Direct and Indirect Labor Requirements in Manufacturing, 1971 (Man-Years per One Million 1970 Cruzeiros of Value of Production or of Value Added)**

	Value of Production			Value Added		
Manufacturing Sector	Direct[a]	Indirect	Total	Direct[a]	Indirect	Total
Nonmetallic minerals	48.73	11.08	59.81	88.65	21.51	110.16
Metal products	18.37	11.29	29.66	49.15	29.04	78.19
Machinery	27.18	12.15	39.33	53.82	28.13	81.95
Electrical equipment	21.06	12.03	33.09	45.06	28.48	73.54
Transportation equipment	16.58	14.96	31.54	41.11	35.07	76.18
Wood products	51.07	30.37	81.44	120.64	72.15	192.79
Furniture	50.67	16.78	67.45	105.78	40.67	146.45
Paper products	23.54	10.07	33.61	58.26	24.85	83.11
Rubber products	16.61	8.14	24.75	34.41	19.52	53.93
Leather and hides	34.37	20.30	54.67	88.32	50.93	139.25
Chemicals	8.22	6.47	14.69	21.88	15.75	37.63
Pharmaceuticals	12.33	6.92	19.25	18.90	14.71	33.61
Perfumery	11.86	9.44	21.30	26.26	22.84	49.10
Plastics	22.11	8.51	30.62	46.89	20.69	67.58
Textiles	31.67	13.91	45.58	77.38	34.24	111.62
Clothing and footwear	41.82	30.54	72.36	102.20	74.97	177.17
Food	15.82	10.92	26.74	61.24	32.71	93.95
Beverages	26.70	9.08	35.78	58.19	21.26	79.45
Tobacco	13.01	1.79	14.80	22.06	4.04	26.10
Printing and publishing	33.06	10.83	43.89	55.87	23.98	79.85
Miscellaneous	33.83	10.62	44.45	62.52	23.95	86.47

Source: Census of 1970 and input-output matrix for 1971; see text for computations.

[a]Taken as equal to the direct requirements for 1970 from the census.

Table 2.13 **Total Labor Requirements in Manufacturing, 1959 and 1971 (Man-Years per One Million 1970 Cruzeiros Increase in Value of Production or in Value Added)**

Source of Increase in Demand[a]	Value of Production		Value Added	
	1959[b]	1971	1959[b]	1971
Import substitution	50	31	128	71
Exports	36	37	115	87

Source: See text.

[a]Computed from the overall composition of value added or value of production in manufacturing for 1959 and 1970.

[b]To obtain values in current cruzeiros, divide figures for labor requirements by 0.02235.

Table 2.14 **Total Labor Requirements in Manufacturing Exports by Destination, 1959, 1970, and 1972 (Man-Years per One Million 1970 Cruzeiros Increase in Value of Production or in Value Added of Exports)**

Export Destination	Value of Production			Value Added		
	1959	1970	1972	1959	1970	1972
United States and Canada	38	34	42	115	94	106
European Economic Community	32	33	43	114	85	112
Latin American Free Trade Area	53	34	34	141	79	78
Other developing countries	42	29	25	133	72	62

Source: See text. For data on exports, see Carvalho and Haddad (1978, appendix table A.13).

Note: For 1959 the direct plus indirect labor requirement vector was obtained from the input-output table of 1959; for 1970 and 1972 this vector was based on the matrix of 1971. Results for 1959 and 1972 have been converted to 1970 prices.

were not only small in value but also heavily weighted by food and chemical products (the latter consisting mainly of raw vegetable oils). Since the labor/output ratios for both of these sectors are likely to be seriously understated because of the omission of (indirect) agricultural labor input, it is not surprising to find a low ratio of labor absorption in 1959. It is also possible that the 1959 system of incentives distorted production to the extent that it reversed the pattern of labor requirements from what one might expect in the absence of commodity market distortions. The relative difference between import substitutes and exports is narrowed, though, when we consider labor in relation to value added instead of value of production. As the weights change from value

of production to value added, exports become proportionately more weighted with labor-intensive industries while imports become proportionately more capital-intensive.

The results for 1971 match our expectations. Exports were labor-intensive relative to import-competing industries, with labor coefficients being about 20 percent higher in exports when value-of-production weights were used and 23 percent higher when value-added weights were used.

Next we proceeded to estimate exportable labor requirements by destination of exports. Four destinations were used: the United States and Canada; the European Economic Community (EEC);[17] other Latin American countries (LAFTA);[18] and other developing countries.

Estimates were made for 1959, 1970, and 1972 trade patterns, using the census data and the input-output matrixes for 1959 and 1971. The results are shown in table 2.14.

Given Brazil's factor endowments, we expected that exports to developed countries would have larger labor requirements than those for LDC trade. Again, the 1959 estimates do not meet these expectations, probably because, as we mentioned before, exports of manufactures in that year still consisted mainly of food and vegetable oils. However, the results for 1970 and 1972 are fairly robust; the pattern of labor requirements meets our expectations except that exports to LAFTA in 1970 were as labor-intensive per unit of value of production as those to the United States and EEC. It is possible that the preferences accorded manufactures in LAFTA countries may have affected these estimates. LAFTA countries have lower, and in some cases zero, duties on Brazilian exports. Thus Brazil may be able to export more labor-intensive production within LAFTA. When we use value-added weights, the anomaly with respect to 1970 LAFTA exports disappears and the ranking by country grouping for 1970 and 1972 is consistent with Brazil's factor endowment, but the 1959 estimates remained inverted.

Estimates for 1970 and 1967–74

The 1970 Instituto Brasilero de Geografia e Estatistica (IBGE) matrix is much more disaggregated than the earlier ones but covers only mining and manufacturing activities. Therefore the problems concerning the linkages with the other sectors of the economy still remain.[19] The matrix consists of fifty-eight sectors, two in mining and fifty-six in manufacturing activities. This disaggregation, corresponding roughly to a three-digit classification, is a substantial improvement over the twenty-one manufacturing activities in the other I-0 tables.[20]

The IBGE matrix also included a vector of total (direct and indirect) labor requirements (production workers only) per value of production (again *industrial* employment only) for the same fifty-eight sectors.

Therefore our task was simply to classify 1970 imports and exports into the same categories as the matrix. (Imports and exports are presented in a disaggregated form in appendix table 2.A.3.) We should note two points. First, the classification was made from the dollar and not the cruzeiro value of imports and exports as was done previously, since the four-digit classification was available only in dollars. Second, in a few cases the classification was somewhat arbitrary, since we did not know the exact nature of the products included either in the matrix sectors or in the trade categories.

We then repeated the exercise described above to obtain labor requirements in terms of value of production and value added. These total labor requirements are (in man-years per million cruzeiros of exports or import substitutes):

	Value-of-Production Basis	*Value-Added Basis*
Exports of manufactures	23.3	39.3
Import substitutes	24.4	36.0

The values are lower than those for 1971 given in table 2.11 because these estimates refer to production workers only. Those of table 2.11 include all employees. Observe that the previously obtained higher labor requirement for exports disappears when computed on a value-of-production basis and is greatly reduced when computed on a value-added basis. We tried to determine whether this difference stems from differences in the input-output coefficients for 1970 and 1971 or changes in the composition of the trade flows from one year to the next. To do so, we aggregated the labor requirements of the IBGE 1970 matrix.[21] (The Spearman correlation coefficients among the labor/output vectors for the two matrixes were 0.99 for the direct and 0.97 for the total requirements.) Next we calculated labor requirements annually for the period 1967–74 by applying the IBGE matrix to trade flows in each year. The results, in table 2.15, suggest two conclusions. First, the larger exportable labor requirements (per unit of value of production) reemerge in the results for 1970, but the change is so small as to suggest that the difference in level of aggregation does not make a great deal of difference in the results. Second, and more interesting, the composition of Brazil's exports has shifted in a more labor-intensive direction as export promotion efforts progressed after 1967. This observation also can be extended back to 1959, since it corresponds with the earlier observed increase in labor requirements in exportables between that year and 1971. Thus, the difference in calculated labor requirements appears to be much more the consequence of changes in the composition of trade flows than of changes in coefficients.

Table 2.15 **Total Requirements of Production Workers in Manufacturing, 1967–74 (Man-Years per One Million 1970 Cruzeiros Increase in Value of Production)**

Years	Import Substitution[a] (1)	Exports[a] (2)	(2)/(1) (3)
1967	22	22	1.00
1968	23	22	.96
1969	23	20	.87
1970	23	24	1.04
1971	23	26	1.13
1972	24	28	1.17
1973	23	29	1.26
1974	22	28	1.27

Source: Labor requirements in man-years from IBGE input-output matrix. For details on computations, see text.

Note: Takes into account only the industrial sector.

[a]Computed from the composition of imports and exports of manufactures in each year.

2.4.2 Labor Requirements by Major Trade Categories

Thus far we have derived our labor coefficients using total exports and total imports of manufactures regardless of their source. Now we wish to compute labor coefficients for trade categories corresponding more closely to those outlined in the introductory chapter of this volume. To do so, we classified activities into exportables, importables, or noncompeting production on the basis of the share of net imports (imports minus exports) in total consumption (production plus imports minus exports). Calling that statistic T, manufactures were categorized:

(a) as non-import-competing activities if T was greater than 0.75;
(b) as importable activities if T fell between 0.05 and 0.75;
(c) as marginal trade activities if T fell between ± 0.05; and
(d) as exportable activities if T was less than -0.05.

The above criteria were modified in some cases by a judgment of the nature of the product. For instance, glass, automobiles and parts, rubber, and plastics would be classified as marginal trade items following these criteria. However they are clearly import-competing products and are so treated here.

Using this procedure, there were thirty-six importable, twelve marginal, and eight exportable activities in the fifty-six-activity 1970 IBGE matrix. Since the statistic T is always below 0.6 at our level of aggregation, no activity was classified as noncompeting. Of the exportables, five were further classified as processed natural-resource-based (NRB) and

three as Heckscher-Ohlin-Samuelson (HOS) goods. The processed NRB exportables are wood products, leather and hides, raw vegetable oils, spun and woven natural fibers, and sugar. The HOS exportables are iron and steel, footwear, and other foodstuffs (see appendix table 2.A.3 for a complete listing of all activities and trade flows for each activity).

Weighted average labor requirements for each category are shown in two ways in table 2.16; one gives the direct labor content per unit of production or value added, and the other includes indirect labor (in the numerator) and indirect output or value added (in the denominator) of supplying manufacturing industries. Note that, as we mentioned earlier, these estimates use the procedure outlined in chapter 1 of this volume; those of tables 2.11 to 2.15 do not. These results are similar to those presented earlier. Manufactures classified as HOS exportables had significantly higher labor requirements than import competing manufactures irrespective of the measure (direct or direct plus indirect) or the weight (value added or value of production) used.

2.4.3 Skill Intensities of Brazilian Imports and Exports

In sections 2.3.1 and 2.3.2 we determined that Brazilian exports have higher labor requirements than Brazilian imports. It is important to extend this analysis further to make inferences of labor requirements, according to the skill content of the work force. That is the purpose of this section. Skill contents have been generally estimated with an arbitrary

Table 2.16 **Labor Requirements by Trade Categories, 1970 (Man-Years per One Million Cruzeiros of Value of Production or Value Added)**

	Direct Requirements per Unit		Direct Plus Indirect Requirements per Unit	
Trade Category[a]	Value of Production	Direct Value Added	Value of Production	Direct Plus Indirect Value Added
Import competing products	16.0	31.4	22.8	30.9
Exportables	22.3	63.9	30.2	57.8
NRB goods	24.9	63.4	32.1	61.0
HOS goods	18.0	65.1	27.1	51.1
Marginal trade items	18.2	46.8	24.4	45.7

Source: See text.

Note: Weighted by the composition of the value of production in each category for 1970. Estimates cover production workers only.

[a]Defined using the statistic T with some adjustments.

weighting of the number of persons employed in each skill category.[22] An alternative method is to compute an index based on wages. However, this measure includes other factors besides skills that do not pertain just to the "quality" of the labor force. We propose to use a variation of the wage index to approximate labor skills.

Previous work by Senna (1975) simplified our task. Using data for 1970 from the Two-thirds Law,[23] he developed a model similar to that of Mincer (1974) to explain the differences in the effects of schooling and job experience on the labor earnings. This model is given by the equation:

$$(1) \qquad ln\ W_i = \alpha + \beta_1 S_i + \beta_2 J_i + \beta_3 J_i^2 + u_i,$$

where

$ln\ W_i$ = logarithm of wages and salaries of worker i;
S_i = schooling, measured by the number of full years of formal school attendance, for worker i;
J_i = job experience, measured by the number of years in the labor force, for worker i;
u_i = residual due to other effects.

We propose to use the estimated wage ($\hat{ln}\ W_i$) implied by Senna's model to construct an index of labor skill. The advantage of using $\hat{ln}\ W_i$ rather than actual wages ($ln\ W_i$) is that we are certain to capture the human capital content of the labor earnings. Thus, occasional quasi-rents or other distortions generated by transitory events will be left out of $\hat{ln}\ W_i$ (but not of $ln\ W_i$). That is, under the hypotheses associated with equation (1), $\hat{ln}\ W_i$ reflects only skill contents of the labor force.[24] We first computed the implied $\hat{ln}\ W_i$ for each worker, then calculated the average of $\hat{ln}\ W_i$ for each activity. The index was constructed from the anti-*ln* of the averages using as base the anti-*ln* of the overall weighted average of $\hat{ln}\ W_i$—that is, the estimated overall average. The results are presented in table 2.17.

To determine the total average skill intensities, we proceeded to calculate the production requirements for an increase of one million cruzeiros of final demand from exportables or importables for 1959[25] and 1971.

Next we constructed a weighted average of the direct and direct-indirect skill indexes for exportables and importables using as weights the production requirements in each industry divided by the total production requirements. The results are presented in table 2.18. For 1971 we also present figures in parentheses computed directly from average wages.

Observe first (in table 2.17) the wide range of skill index values (89.4 to 165.4). However, most (17) activities had skill index values

Table 2.17 Skill Content Indexes for Selected Sectors, 1970

Sector	Sample Size	Model Adjusted for Brazil: Estimated Average Wage[a]	Model Adjusted for Brazil: Index of Skill (3.684 = 100)
Vegetable extraction	561	3.66	99.4
Mining	1,057	3.49	94.7
Food	2,384	3.59	97.5
Beverages	682	3.83	103.9
Tobacco	156	4.11	111.5
Textiles	1,670	3.71	100.7
Clothing and footwear	861	3.64	98.8
Wood products	1,167	3.33	90.3
Furniture	1,055	3.44	93.3
Paper products	690	3.57	96.9
Printing and publishing	870	4.08	110.7
Leather products	558	3.61	98.1
Rubber products	773	3.78	102.5
Chemicals	872	4.54	123.1
Oil and derivatives	275	6.09	165.4
Plastics	433	3.84	104.3
Nonmetallic minerals	1,498	3.40	92.4
Metal products	1,139	3.99	108.4
Machinery	4,663	3.90	105.9
Transportation equipment	1,753	3.99	108.2
Construction	5,125	3.29	89.4
Electricity generation	427	4.64	125.9
Miscellaneous	1,099	3.50	95.1

[a] Anti-$ln\left[\frac{\hat{ln}\, W_i}{n}\right]$.

within ±10 percent of the average for manufacturing. When skill content indexes were calculated for exportables and importables (table 2.18), we note that importables were more skill-intensive than exportables in both 1959 and 1971, with the difference being more marked for 1959, at least with regard to direct skill requirements. For 1971 the use of average wages as a proxy for skill content (see values in parentheses) also indicates that Brazilian imports are more skill-intensive than Brazilian exports. The inclusion of indirect requirements makes skill content differences larger in 1959 but smaller in 1971. In fact, in 1974 there is no difference between the direct plus indirect skill contents of exportables and importables. Our findings are broadly consistent with the HOS

model of factor proportions, since the average skill content of the Brazilian work force is certainly lower than those of Brazil's major trading partners.[26]

2.4.4 Summary

In this section we have presented estimates of total labor requirements and the skill contents of Brazilian exportable and importable production. These estimates indicate first that Brazil's exportable production has become more labor-intensive since 1959. Second, estimated total labor coefficients are consistent with the expectations of the HOS model—namely, Brazil's exportables had higher labor requirements than her importables (in 1970–71), regardless of the weight (value of production or value added) or the labor requirement measure (direct or direct plus indirect) used. Third, estimated exportable labor requirements by destination of exports (DC or LDC) are also consistent with the HOS model, with export to developed nations having higher labor requirements than exports to developing nations. Finally, the skill content estimates suggest a complementarity between human and physical capital. Brazil's production of importables requires less labor (and presumably more capital) but more skill than her production of exportables.

Table 2.18 **Index of Average Skill Content of Brazilian Imports and Exports for 1959 and 1971**

	Average Skill Content Indexes	
Indexes	Direct Labor Requirements	Direct and Indirect Labor Requirements
1959		
Imports	100.3	168.4
Exports	95.7	130.6
1971		
Imports	111.9	174.4
	(130)	(199)
Exports	109.5	174.9
	(120)	(187)

Source: See text and table 2.17 for construction of index. (The base is the average direct skill requirements for each year.)
Note: The values in parentheses are the corresponding indexes based on average wages.

2.5 Factor Market Distortions and Factor Use: Trade and Employment Revisited

In this section we will describe the main factor market distortions and their possible effects on factor use.

2.5.1 The Labor Market

There are many phenomena that may cause labor market distortions in Brazil. We will concentrate our attention here upon the possible distortions generated by the minimum wage and the social security legislation which in our judgment are potentially the most important causes of labor market distortions.[27]

From the technical point of view, effective minimum wage legislation burdens less-skilled workers by limiting their employment and inducing people to hire better-qualified workers at the minimum wage level. Despite the lack of data to quantify the effects of minimum wage legislation, we do not think that minimum wage legislation has created significant distortions.

To support our argument, we calculated the distribution of industrial workers by wage levels where various wage levels were defined as fractions of the highest minimum wage in Brazil. (Unfortunately this information was not consistently available over time; the ratio of median wage to minimum wage was also used; see Carvalho and Haddad 1978, chap. 5.) Our calculations indicate that most workers earn more than the minimum, so that it may be inferred that the minimum wage was not effective. The main reason the minimum wage was not effective was inflation. The nominal minimum wage was often kept constant in the presence of inflation, so that, except in years when changes in the nominal minimum wage occurred, the number of workers earning more than the minimum wage increased. This has been especially true in recent years. For example, there was a substantial increase in the percentage of workers earning more than 3.7 times the minimum wage in 1972. In fact, almost 44 percent of total workers belonged to that group in 1972, compared to just 14 percent in 1968.

Since the minimum wage was kept fairly constant in real terms from 1968 to 1972, and since more workers have been earning more than the minimum wage, we can infer that the average real wage increased substantially during that period. In fact from 1968 to 1972 the average wage in manufacturing increased by about 21 percent in real terms.

Another potential cause of labor market distortions is the social security program that was introduced in 1945. According to Bacha, Mata, and Modenesi (1972), social security taxation was 7.9 percent of wages in 1945. Since then it has increased gradually to a rate of 43.9 percent in 1971. Since 1971, other labor legislation has been enacted introducing

some other taxes. Generally these have had a small effect on the labor market.[28]

The legal social security rates are the same for all manufacturing sectors. However, firms may actually be subject to a lower rate for a variety of reasons (for details, see Bacha, Mata, and Modenesi 1972, Appendix A-3). For example, the Instituto Nacional do Previdencia Social (INPS) portion of the contribution[29] applies up to the limit of twenty times the minimum wage in Rio de Janeiro. This implies discrimination against unskilled labor in that city. We can draw inferences about the effect of social security legislation by computing the effective tax paid by each industry. This was possible only for the census years. Thus, for 1970 we computed the tax rate on labor by dividing social security payments by total payments to labor. In this way we have the effective proportional tax rate imposed on labor in each industrial activity at a two-digit level of disaggregation. These effective rates ranged from 22.85 percent to 29.72 percent in 1970. The average was 27.13 percent. Thus, there was a 30 percent difference between the lowest and highest rates. This difference certainly affected labor utilization in Brazil. The results will be used in section 2.5.3, where we attempt to quantify the effects of factor market distortions.

2.5.2 The Capital Market

As in other developing countries, capital markets were fragmented and highly distorted in Brazil until 1964. After 1964 many institutional changes, the most important one being the creation of "monetary correction," produced a sharp rise in financial intermediation. New financial assets and institutions were created, and by now it can be said that capital markets in Brazil are very developed and sophisticated when compared with those in other LDCs.

Since we are interested in the distortions in the use of capital, we will ignore incentives affecting savings and concentrate on those affecting investment. The potential distortions come from two sources: artificially low prices of capital goods, especially machinery and equipment, and subsidies in the form of credit at below market rates.

The Behavior of Prices of Capital Goods

The main distortion in the prices of capital goods is due to tariff differentials between capital goods and consumer goods. As we mentioned in section 2.3, nominal rates for capital goods imports have traditionally been lower than those for consumer goods. Also, recall that the allocation of foreign exchange from 1950 to 1957 tended to favor imports of raw materials and capital equipment.

It is also relevant to observe that, over the period 1955 to 1974, prices of capital goods in Brazil have risen less rapidly than in general. In the

same period, real wages increased dramatically. Our calculations indicate that over these twenty years, the prices of imported capital goods inclusive of tariffs have risen less than half as much as wholesale prices in Brazil, while real wages in manufacturing rose by 80 percent in the same period (Carvalho and Haddad 1978, chap. 5). Thus nominal wages rose faster and the price of capital goods rose at a lower rate than inflation. Capital utilization ought to have been encouraged.

Distortions in the Credit Market

Until 1964, credit possibilities were limited principally to short-term loans to finance working capital made by the commercial banking system. Government credit policies were executed until 1952 through the Banco do Brasil, which acted as the central bank and revenue agent of the government. It also lent, at subsidized interest rates, to some favored sectors of the economy. After the creation of Banco Nacional de Desenvolvimento Econômico (BNDE), many of the lending activities of Banco do Brasil were transferred to it. From 1955 to 1963, all the credit operations of the BNDE were carried through the Fund for Economic Re-Equipment (FRE). The lion's share of the loans during 1955–57 went to public utilities. In this initial period the credit operations of the BNDE were limited in scope.

The conditions of the BNDE loans vary. The interest rate on the FRE (terms up to twenty years) ranged from 4 to 12 percent, depending on the sector that received the loan, plus monetary correction. The BNDE also has other lending facilities, such as FINAME (Special Fund Agency for Industrial Financing), FIPEME (Financing of Small and Medium Enterprises), FUNGIRO (Special Fund for the Financing of Working Capital), and FRMI (Fund for Industrial Modernization and Reorganization).

In all its operations, the real rate of interest on the BNDE loans was generally low (below 5 percent). Since some studies place the real private rate of return on capital in Brazil in the period 1954–67 at about 12 percent per year (see, e.g., Langoni 1973, p. 29), and since the minimum real rate on savings in Brazil during 1965–75 equaled 6 percent,[30] the market rate of interest charged on loans may be put at 10 percent plus full monetary correction.[31] We can then compute the implicit subsidy on the BNDE loans under several assumptions concerning terms and loan rates. The subsidy rate is the difference between the value of the loan and the present value of the implicit flow of payments on the loan, discounted at a real interest rate of 10 percent.

We assumed repayments in equal installments of $i/2$ percent each half-year, where i is the interest rate. This procedure tends to underestimate the subsidy. The results obtained were not sensitive to the assumptions concerning payments conditions, but the implicit subsidy rate varied

substantially according to the interest rate and its term. For the period 1965–74, we estimated an implicit subsidy in BNDE loans varying from 10 percent to 50 percent of the value of the loan. On the average, we believe that this subsidy would be about 20 percent, which corresponds to a ten-year loan at a 4 percent real interest rate or to a six-year loan at a 2 percent real interest rate. Since the BNDE system financed about 60 to 70 percent of the cost of capital goods of the loan recipients during 1965–74, we can conclude, assuming that the remaining funds were obtained at market rates, that there was an average implicit subsidy of about 12 percent in the acquisition of capital goods partly financed by BNDE.

Although the BNDE loans are the most important among subsidized loans, they still constitute a very limited part of industrial loans. As table 2.19 shows, the average share of BNDE loans in total investment during 1967–69 was only 17 percent. With the exception of metal products, all groups of industries received less than 15 percent. Consequently, the average industrywide implicit subsidy rate was only 3.4 percent. In fact, for most industries the rates were less than 3 percent (table 2.19).

2.5.3 The Effect of Factor Market Distortions

During the import substitution process in Brazil, the technology used in production was similar to that of the countries exporting capital goods to Brazil; very few capital goods were produced locally. Thus, during that period, the nature of imported technology and the relative factor-price ratio tended to favor the use of capital over labor.

We have developed a model (presented in detail in Appendix C), that relates the effects of factor market distortions on factor utilization. The

Table 2.19 **Average Share of BNDE Loans in Total Investment and Implicit Subsidy, 1967–69 (Percentage)**

Sector	Average Share	Implicit Subsidy
Nonmetallic minerals	12	2.4
Metal products	55	11.0
Machinery and electric equipment	12	2.4
Transportation equipment	14	2.8
Chemicals[a]	10	2.0
Textiles[b]	8	1.6
Other[c]	8	1.6
Total manufacturing	17	3.4

Source: See text.

[a]Includes chemicals, perfumery, pharmaceuticals, and plastics.

[b]Includes textiles, clothing, and footwear.

[c]Includes food, beverages, tobacco, wood, furniture, paper, leather, publishing, rubber, and miscellaneous.

two distortions analyzed by the model are social security payments and subsidies to capital from BNDE loans only, both of which were described above.

The model can be reduced to a system of equations from which labor coefficients can be derived, given values for elasticities of substitution of capital for labor and elasticities of factor supply in each industry. (These are denoted as σ, ϵ_K, and ϵ_ℓ in the discussion that follows.) Estimates of elasticities of substitution for the twenty-one industrial activities were available from Macedo (1974); no information on supply elasticities (ϵ_K and ϵ_ℓ) was available, so the model was solved for the following three assumptions: (1) infinite labor and capital supply elasticities; (2) both labor and capital supply elasticities equal to unity; and (3) a capital supply elasticity of two, a labor supply elasticity of one.

Consider first the case of infinite supply elasticities. For this case we calculated percentage changes in employment in each activity resulting from each distortion, then applied those percentage changes to the direct labor requirements (per unit of value of production) actually observed in 1970. This gives us an estimate of what labor absorption would have been in 1970 had either the social security tax or the BNDE subsidy (or both) been eliminated. Our results are shown in table 2.20; the first four columns give the effects on direct coefficients; the last four give the effects upon total labor coefficients. Columns 2 and 6 give the new labor coefficient had the social security tax been eliminated; columns 3 and 7 give the effects of eliminating the subsidy to capital; and columns 4 and 8 give the effects of both policies.

A comparison of the nondistorted labor coefficients with the actually observed labor requirements indicates that the social security legislation had a much more significant effect on direct labor absorption than did the BNDE subsidy. This is true for both direct and total labor requirements. Actually, the effect of social security legislation on the labor/output ratio would be, on the average, 18 percent if no subsidy was given to capital. This follows from the fact that, on average, the elasticity of substitution is about one, the share of labor in value added is about 35 percent, and the share of social security in the wage bill is about 27 percent ($1 \times 0.65 \times 0.27 = 0.18$). By the same token, the effect of the subsidy to capital (if wages are unchanged) on labor output ratio would be, on the aggregate, about 2 percent ($1 \times 0.65 \times 0.034$).

Now consider the case where factor supplies are not perfectly elastic.[32] In table 2.21 we present percentage changes in capital and labor utilization and the degree of factor market distortions (as a percentage of market prices of capital and labor) under the two sets of supply elasticity assumptions outlined above. In table 2.22 we have recomputed the new vector of total labor requirements when both distortions are removed.

Table 2.20 **Direct and Total Labor Requirements Produced by Policy Changes, 1970 (Man-Years per One Million 1970 Cruzeiros of Value of Production)**

Sectors	Direct				Total			
	Actual in 1970 (1)	From Change in Social Security (2)	From Elimination of Subsidies to Capital (3)	From Both Policies (4)	Actual in 1970 (5)	From Change in Social Security (6)	From Elimination of Subsidies to Capital (7)	From Both Policies (8)
Nonmetallic minerals	48.73	54.57	49.30	55.14	67.46	75.54	68.24	76.32
Metal products	18.37	20.79	19.39	21.81	29.10	32.93	30.71	34.54
Machinery	27.18	30.64	27.53	30.99	42.27	47.65	42.81	48.19
Electrical equipment	21.06	23.97	21.35	24.26	33.50	38.12	33.96	38.58
Transportation equipment	16.58	19.25	16.89	19.56	28.80	33.43	29.34	33.97
Wood products	51.07	57.62	51.57	58.12	89.64	101.14	90.52	102.02
Furniture	50.67	55.61	51.02	55.96	81.62	89.58	82.19	90.15
Paper products	23.54	26.66	23.75	26.87	35.01	39.65	35.32	39.96
Rubber products	16.61	19.66	16.83	19.88	25.24	29.88	25.58	30.22
Leather products	24.37	38.29	34.64	38.56	61.75	68.79	62.23	69.27
Chemicals	8.22	9.22	8.31	9.31	11.97	13.43	12.10	13.56
Pharmaceuticals	12.33	15.19	12.58	15.44	16.72	20.60	17.06	20.94
Perfumery	11.86	13.92	12.04	14.10	18.38	21.57	18.66	21.85
Plastics	12.11	14.53	12.32	14.74	18.67	22.40	18.99	22.72
Textiles	31.67	34.99	31.89	35.21	52.70	58.22	53.06	58.58
Clothing and footwear	41.82	47.34	42.24	47.76	89.89	101.76	90.79	102.66
Food	15.82	18.58	15.99	18.75	26.54	31.18	26.83	31.47
Beverages	26.70	31.69	27.05	32.04	36.48	43.30	36.96	43.78
Tobacco	13.01	16.76	13.29	17.04	14.42	18.58	14.74	18.90
Printing and publishing	33.06	36.68	33.36	36.98	48.50	53.81	48.94	54.25
Miscellaneous	33.83	37.56	34.10	37.83	48.55	53.91	48.94	54.30

This was accomplished by increasing the direct labor requirements by the percentages[33] from table 2.21 and applying the new vectors to the matrix $(I\text{-}A)^{-1}$.

The existence of an implicit subsidy to capital due to BNDE credits plus a tax on labor would have produced an increase of 5.1 percent in the price received by capital owners and a drop of 9.4 percent in the price received by the workers in the industrial sector compared with the undistorted situation (with unitary supply elasticities). As we would expect, when we increase the value of the elasticity of supply of capital, both the fall in the wage paid and the increase in the rental price of capital are reduced. Accordingly, the effects on the use of factors are less pronounced. With unitary supply elasticities, labor requirements are reduced by 5.35 to 22.91 percent while capital utilization is increased by 2.68 to 7.30 percent. As the capital supply elasticity increases to two, the effects of distortions upon both capital and labor utilization become less pronounced but are still significant.

2.5.4 The Effects of Distortions on Trade and Employment

With the new nondistorted total labor requirements, we can calculate new labor requirements for exportables and importables by multiplying the vectors of sectoral shares of exports and of importables in manufacturing by the new total labor requirements. Two sets of results, computed with 1971 data, are shown in table 2.23. The first set assumes perfectly elastic factor supplies and uses the total labor requirements of table 2.20. The second set assumes the same factor elasticities used in constructing tables 2.21 and 2.22 and uses total labor requirements of table 2.12. The first set contains three estimates: (1) elimination of the social security tax; (2) elimination of the subsidies to capital implicit in the loans from the BNDE; and (3) policies 1 and 2 taken simultaneously. The second set of results considers only the simultaneous elimination of both distortions.

For the perfectly elastic factor supply case, eliminating the capital subsidy would affect the total labor requirements only marginally. The

Notes to Table 2.20: Col. 1 is from table 2.12. Col. 5 differs slightly from total column in table 2.12 because of differences in refinement of calculations. Cols. 2 and 6 are estimates of requirements that would follow from removal of tax on labor implicit in social security legislation. Cols. 3 and 7 are estimates of requirements that would follow from elimination of subsidy to capital from BNDE. Cols. 4 and 8 are equal to (2) + (3) − (1), and (6) + (7) − (5), respectively.

Notes to Table 2.21: [a]Macedo (1974). The elasticity of substitution for miscellaneous was taken as the industrial average.
[b]Table 2.14 above, taken as proportion of the supply price. The aggregated values were considered constant for each subsector involved in the aggregation.
[c]Industrial census of 1970. Taken as proportion of the supply price. For more details see Carvalho and Haddad (1978, Chap. 5).

Table 2.21 **Effects of Factor Price Distortions with Supplies Not Perfectly Elastic, 1970**

	If $\varepsilon_K = 1.0$ and $\varepsilon_\ell = 1.0$		If $\varepsilon_K = 2.0$ and $\varepsilon_\ell = 1.0$			Capital Market Distortions as a Percentage of the Market Rental Value of Capital[b]	Labor Market Distortions as a Percentage of the Market Wage[c]
	% Δ in capital (1)	% Δ in labor (2)	% Δ in capital (3)	% Δ in labor (4)	σ_i[a] (5)	(6)	(7)
Nonmetallic minerals	4.36	− 7.43	3.67	− 6.27	81	2.4	26.6
Metal products	7.43	−13.36	6.75	−12.13	84	11.0	28.2
Machinery	7.66	− 7.94	6.46	− 6.69	108	2.4	26.5
Electrical equipment	5.68	− 8.90	4.84	− 7.58	5	2.4	27.4
Transportation equipment	7.78	−11.37	6.73	− 9.85	113	2.8	28.6
Wood products	4.70	− 6.87	3.76	− 5.49	102	1.6	24.2
Furniture	4.26	− 5.09	3.42	− 4.09	81	1.6	24.4
Paper products	5.54	− 7.99	4.64	− 6.69	97	1.6	26.8
Rubber products	4.54	−11.76	3.80	− 9.85	116	1.6	26.9
Leather products	4.29	− 6.58	3.55	− 5.45	82	1.6	26.1
Chemicals	2.39	− 7.30	2.00	− 6.10	70	2.0	26.3
Pharmaceuticals	4.48	−17.03	3.84	−14.62	134	2.0	28.5
Perfumery	2.68	−11.60	2.28	− 9.88	93	2.0	27.8
Plastics	6.13	−14.18	5.27	−12.20	125	2.0	28.7
Textiles	4.17	− 6.30	3.53	− 5.34	70	1.6	27.8
Clothing and footwear	5.21	− 7.33	4.22	− 5.94	105	1.6	24.8
Food	4.09	−11.89	3.53	−10.27	96	1.6	29.5
Beverages	7.30	−12.67	6.25	−10.85	126	1.6	28.7
Tobacco	5.06	−22.91	4.37	−19.82	166	1.6	29.7
Printing and publishing	5.00	− 5.35	3.86	− 4.12	104	1.6	22.8
Miscellaneous	4.05	− 6.12	3.31	− 5.01	81[a]	1.6	25.4
% Δ in market rental value of capital	5.09		2.18				
% Δ in market wage	−9.36		−8.01				

Table 2.22 **Total Labor Requirements in Industry Produced by Policy Changes with Factor Supplies Not Perfectly Elastic, 1970 (in Man-Years)**

Sectors	Actual in 1970 (1)	$\varepsilon_K = 1$ $\varepsilon_\ell = 1$ (2)	$\varepsilon_K = 2$ $\varepsilon_\ell = 1$ (3)
Nonmetallic minerals	67.46	72.12	71.44
Metal products	29.10	32.52	32.25
Machinery	42.27	45.38	44.91
Electrical equipment	33.50	36.23	35.85
Transportation equipment	28.80	31.73	31.38
Wood products	89.64	95.40	94.31
Furniture	81.62	85.57	84.83
Paper products	35.01	37.59	37.21
Rubber products	25.24	27.90	27.51
Leather products	61.75	65.56	64.94
Chemicals	11.97	12.79	12.66
Pharmaceuticals	16.72	19.15	18.85
Perfumery	18.38	20.28	20.04
Plastics	18.67	20.98	20.70
Textiles	52.70	55.82	55.38
Clothing and footwear	89.89	96.04	94.94
Food	26.54	29.36	29.01
Beverages	36.48	40.58	40.05
Tobacco	14.42	17.12	16.81
Printing and publishing	48.50	50.96	50.42
Miscellaneous	48.55	51.35	50.86

Source: See text and table 2.21.

Note: Changes are the elimination of the tax on labor implicit in the social security legislation and the elimination of subsidies to capital.

absorption of labor in importables would increase by about 2 percent (from 30.9 to 31.5); in exportables the increase would be about 1.5 percent. The slightly larger increase in importable labor requirements is due to the fact that investment in importables is more heavily subsidized than investment in exportables.

The elimination of the tax implicit in social security would have a major effect upon labor absorption. Taken alone, it would increase labor requirements by 13.3 percent in the importable industries and by 13.6 percent in the exportables. Taken together, the two policies would increase labor absorption per unit of output by 15.2 percent in importables and 14.9 percent in exportables. On the whole, the increase would be about the same in both industries, and the relative labor intensities would not be changed.

Table 2.23 **Total Labor Requirements in Industry under Assumed Changes in Policy, 1971 (Man-Years per One Million 1970 Cruzeiros Increase in Value of Production)**

Source of Increase in Demand	Changes in Policy Assuming Perfectly Elastic Supplies of Factors				Changes in Policy Given by (1) and (2) and Assuming Factor Supply Elasticities Equal to	
	No Change in Policy	Elimination of Tax on Labor (1)	Elimination of Subsidy to Capital (2)	Both (1) and (2) (3)	$\varepsilon_\ell = 1$, $\varepsilon_\kappa = 1$ (4)	$\varepsilon_\ell = 1$, $\varepsilon_\kappa = 2$ (5)
Import substitution	30.9	35.0	31.5	35.6	33.5	33.2
Exports	39.7	45.1	40.3	45.6	42.9	42.5

Source: See text.

Results for less than perfectly elastic factor supplies yield more modest changes in labor requirements. For the case of unitary supply elasticities, labor coefficients would increase by 8.4 percent in the importables and by 8.1 percent in exportables. For the case of a unitary labor supply elasticity and a capital supply elasticity of two, the increase in labor coefficients would be 7.4 percent for importables and 7.1 percent for exportables. Again, the relative labor intensities would not be affected.

Therefore we can conclude that the evidence on factor market distortions does not support the expectation that those effects have been highly significant. Of the two distortions examined here, social security legislation is more important. Nonetheless, the employment effect of eliminating both distortions would be considerable in absolute terms. For the case of unitary supply elasticities, their elimination would increase employment per unit of output by about 8 percent. Given the actual size of the labor force in manufacturing (about three million), that increase would imply the creation of 240,000 new jobs with no change in output.

2.6 Summary and Conclusions

Brazil has had both import substitution and export promotion phases in its trade regime. Although the import substitution policy was successful in increasing industrial output, employment did not grow accordingly. Employment growth in the export promotion period has been more substantial since Brazil's exports have been found to be labor-intensive.

Protection was decreased substantially and its cascaded structure reduced after 1965. Exports were subsidized through tax rebates and

subsidies and through subsidized credit. The total subsidy to exports ranged from 15 to 30 percent, depending upon assumptions concerning individual components of the subsidy.

Brazil's production of exportables has higher labor requirements than its production of importables, and its exportable labor requirements have been increasing over time as the trade regime has expanded incentives to export. The pattern of exportable labor requirements by destination of exports was as anticipated from application of the HOS trade model; namely, exports to DCs embody more labor than exports to LDCs. Continued emphasis upon exports to developed nations, then, will generate greater employment than exports to LDCs.

The skill content of Brazil's exports is also lower than that of importables. Thus the export promotion policy currently followed will help generate employment for a growing unskilled labor force.

Two major distortions existed in the factor market—social security taxation and credit subsidization. Minimum wage legislation has not been effective. It is our judgment that the other distortions are not as important as incentives under the trade regime. However, eliminating social security taxation in particular could have significant employment effects. Its removal could potentially alter the wage-rental ratio in such a manner that labor absorption per unit of output would rise by about 8 to 15 percent, depending upon assumptions of supply elasticities. A reasonable assumption is that the supply of unskilled labor is perfectly elastic, so potentially the increase in manufacturing employment might be close to 450,000 workers. However, Brazil's trade strategy probably has had a more significant effect upon employment. Since the export promotion strategy began in 1965, manufacturing employment has increased by about 1.3 million workers, or 85 percent.

In general, then, Brazil's switch to an export promotion policy has been successful in increasing both manufacturing output and employment. Its experience is a valuable lesson for other developing nations.

Appendix A

Table 2.A.1 Exports and Imports of Manufactures, 1959 (Values in Thousands)

	Exports		Imports	
Manufacturing Sector	Cruzeiros	Dollars	Cruzeiros	Dollars
Nonmetallic minerals	41.013	279	2,022.328	11,565
Metal products	17.576	141	15,792.776	127,129
Machinery	140.774	946	22,962.948	223,031
Electrical equipment	11.861	75	7,754.279	64,005
Transportation equipment	85.659	980	18,896.798	211,626
Wood products	228.371	1,543	244.006	2,660
Furniture	.675	4	5.872	21
Paper products	.328	2	4,464.126	49,894
Rubber products	.856	5	152.235	974
Leather and hides	389.666	2,668	126.185	688
Chemicals	3,477.228	33,616	33,079.794	249,962
Pharmaceuticals	58.193	406	2,062.543	10,148
Perfumery	333.363	2,471	186.671	944
Plastics	—	—	4.857	31
Textiles	212.656	1,503	241.943	1,540
Clothing and footwear	13.552	91	4.085	23
Food	4,975.944	35,466	4,539.071	28,488
Beverages	2.151	15	719.765	2,275
Tobacco	12.126	80	21.075	197
Printing and publishing	3.097	52	718.579	7,432
Miscellaneous	34.885	276	2,848.458	17,842
Total manufactures	10,039.974	80,619	116,848.394	1,010,475
Grand total[a]	109,449.699	1,281,969	161,284.017	1,374,473

Source: Carvalho and Haddad (1978, tables A.4–A.7).
[a]All imports and exports.

Table 2.A.2 **Exports and Imports of Manufactures, 1971 (Values in Thousands)**

Manufacturing Sector	Exports		Imports	
	Cruzeiros	Dollars	Cruzeiros	Dollars
Nonmetallic minerals	93,161	17,639	184,009	35,360
Metal products	377,838	67,618	2,496,964	481,544
Machinery	407,632	77,054	3,808,103	757,441
Electrical equipment	152,156	28,529	1,463,777	281,111
Transportation equipment	145,996	27,249	1,755,988	337,989
Wood products	152,686	26,637	11,893	2,282
Furniture	14,767	2,793	1,586	303
Paper products	70,283	13,324	413,754	79,319
Rubber products	24,718	4,451	99,836	19,098
Leather and hides	101,781	14,139	15,606	3,001
Chemicals	288,912	129,206	3,258,198	621,726
Pharmaceuticals	21,573	4,073	237,114	45,867
Perfumery	63,591	12,110	49,955	9,639
Plastics	—	—	11,702	2,234
Textiles	186,554	33,433	224,577	44,650
Clothing and footwear	217,203	34,474	33,010	6,332
Food	808,300	150,553	491,364	94,822
Beverages	9,356	1,780	39,628	7,505
Tobacco	9,710	1,843	378	72
Printing and publishing	31,946	5,922	97,952	18,825
Miscellaneous	37,158	10,563	637,154	122,575
Total manufactures	3,215,321	663,390	15,332,548	2,971,695
Grand total[a]	15,373,766	2,903,856	19,218,408	3,701,449

Source: Carvalho and Haddad (1978, tables A.4–A.7).
[a]All imports and exports.

Table 2.A.3 **Imports and Exports According to the Manufacturing Sectors of the IBGE Matrix, 1970 (Thousands of Dollars)**

Sectors and Codes	Imports	Exports	Trade[a] Category
Mining	23,328	362,283	NRB
Fossil material and fuel exploration	304,420	—	NRB
Cement	7,857	17	MR
Glass	15,448	7,324	IM
Other nonmetallic minerals	7,528	2,436	MR
Iron and steel in primary forms	—	82,471	EX
Rolled steel	75,235	15,310	IM
Cast iron and steel	63,980	—	IM
Metallurgy of nonferrous metals	115,624	1,409	IM
Other metallurgical products	97,513	9,797	IM
Pumps and motors	30,454	2,592	IM
Parts for machinery	98,119	3,298	IM
Industrial machinery and equipment	290,548	23,905	IM
Agricultural machinery and equipment	18,553	1,459	IM
Machinery and equipment for office and domestic use	64,715	32,920	IM
Tractors and earth-moving machines	101,688	8,074	IM
Equipment for electrical energy	26,834	971	IM
Electrical cables and conduits	3,197	214	IM
Electrical material	46,809	7,999	IM
Electrical appliances	91,402	991	IM
Electronic material	17,821	2,151	IM
Communications equipment	79,872	4,856	IM
Automobiles Trucks and buses Parts for automotive vehicles	31,058	9,290	IM
Naval industry	38,592	4,493	IM
Railway stock and other vehicles	89,943	1,089	IM
Wood	1,240	38,358	EX
Furniture	183	1,511	MR
Cellulose and pasteboard	—	828	IM
Paper and cardboard	36,850	344	IM
Paper products	1,017	243	IM
Rubber	7,278	7,393	IM
Leather and hides	595	16,253	EX
Chemical elements and compositions	214,613	19,174	IM
Oil-refining and petrochemicals	47,791	15,027	IM
Coal derivatives	23,128	2	IM
Artificial threads and resins	51,751	575	IM
Raw vegetable oils	46,576	66,649	EX
Pigments (coloring matter), paints, solvents	—	6,531	MR

Table 2.A.3—*continued*

Sectors and Codes	Imports	Exports	Trade[a] Category
Other chemical products	148,732	7,368	IM
Pharmaceuticals	28,971	4,735	IM
Perfumery, soaps, and candles	3,638	8,762	MR
Plastics	2,629	159	IM
Processing of natural fibers	3	937	MR
Spinning and weaving of artificial fibers	20,379	773	IM
Spinning and weaving of natural fibers	5,771	43,552	EX
Other textile industries	8,749	6,264	MR
Clothing	5,888	3,014	MR
Footwear	33	7,914	EX
Agroindustry	71,007	89,436	MR
Sugar refining	2	134,493	EX
Oil-refining and preparation of vegetable fats for human consumption	1,008	844	MR
Other foodstuff products	5,661	81,468	EX
Beverages	6,949	16,542	MR
Tobacco	38	1,378	MR
Printing and publishing	15,668	2,388	IM
Miscellaneous	105,900	4,310	IM
Total	2,602,586	1,172,574	

Source: Carvalho and Haddad (1978, table A.8).
[a]Code: EX = exportable; IM = importable; MR = marginal protection.

Appendix B: The Relationship between Domestic and Export Prices

The following notation is used in the derivation below:

P_d = internal demand price as viewed by the firm;
P_f = internal supply price (does not include IPI but includes ICM on inputs);
P_{fc} = internal factor cost per unit of output;
P_x = international price f.o.b. in domestic currency;
t_1 = ICM tax rate applied to P_f;
t_2 = IPI tax rate applied to P_f;
$\bar{t}_1$ = ICM credit premium equal to t_2 or equal to 0.13 if $t_2 > 0.13$;
$\bar{t}_2$ = IPI credit premium equal to t_2 for $t_2 \leq 0.15$; and equal to 0.15 otherwise;
$t^* = \bar{t}_1 + \bar{t}_2$;
t_3 = income tax rate;
t_4 = tariff rate for imported inputs;
t_5 = market interest rate (i) minus interest rate charged to loans given to export activities (r);
q_1 = fraction of P_f corresponding to inputs subject to ICM tax;
q_2 = fraction of P_f corresponding to inputs subject to IPI tax;
q_3 = profits per unit of output as fraction of P_f;
q_4 = value of imported inputs per unit of output as a fraction of P_f;
q_5 = loans to export activities under special programs (interest rate $= r$) per unit of output as fraction of P_f.

Assume that the export firm receives (1) exemption from ICM, IPI, and from the import duty on inputs;[34] (2) transfers corresponding to the values of ICM and IPI that would have been paid;[35] (3) income tax exemption on export activities; and (4) subsidized interest rates on loans associated with exports. We can express the international price as the domestic price minus all these subsididy elements:

$$(A1) \qquad P_x = P_d - t_1 P_f - t_2 P_f \frac{t_4}{1+t_4} q_4 P_f - t^* \left(P_x - \frac{q_4}{1+t_4} P_f\right) - t_3 q_3 P_f - t_5 q_5 P_f.$$

After some transformation we obtain:[36]

$$(A2) \qquad P_x = P_d \left[\frac{1 - \left(t_1 + t_3 q_3 + \frac{t_4 - t^*}{1+t_4} q_4 + t_5 + q_5\right)}{(1+t_2)\quad(1+t^*)} \right].$$

We can write the export price as being the internal price at factor cost minus the implicit subsidy. First, note that

$$(A3) \qquad P_{fc} = P_d \left[\frac{1 - t_1 - \frac{t_4}{1 + t_4} q_4}{1 + t_2} \right],$$

since $P_x = P_{fc}$ if there is no subsidy.
Introducing P_{fc} in (A1), we obtain:

$$(A4) \qquad P_x = P_f - t^* \left(P_x - \frac{q_4}{1 + t_4} P_f \right) - t_3 q_3 P_f - t_5 q_5 P_f;$$

thus the subsidy is

$$(A5) \qquad S = t^* P_x + \left[- \frac{q_4 t^*}{1 + t_4} + t_3 q_3 + t_5 q_5 \right] P_f.$$

To see the effect of the export promotion policies based on these instruments, in terms of exporting price versus domestic price, let us assume the following values:

$t_1 = 0.13$, legal exporting ICM rate;

$t_2 = 0.10$, arbitrary value. Since the IPI rates vary widely, we are considering that on average it will range from 0.08 to 0.15;

$t_3 = 0.225$. The legal income tax rate is 0.3. Since a deduction of 25 percent is permitted if firms engage in special programs such as reforesting, SUDENE, SUDAM, or EMBRATUR, we assume that they will take advantage of these possibilities, and we consider the rate to be $0.75 \times 0.3 = 0.225$.

$t_4 = 0.25$, arbitrary value: The input import tariffs are very different according to the input. On average it might be between 0.15 to 0.25;

$t_5 = 0.08$. The annual interest difference can be approximated by $\frac{0.8\ (i - r)}{3}$. Taking $i = 0.38$ for a given $r = 0.08$ for this difference;

$t^* = \bar{t}_1 + \bar{t}_2 = 0.2$. Given $t_1 = 0.13$ and $t_2 = 0.10$, we have $\bar{t}_1 = 0.1 = \bar{t}_2$ and therefore $t^* = 0.20$. Note that except for some special cases, the maximum value for t^* is 0.28;

$q_3 = 0.10$ arbitrary value;

$q_4 = 0.30$ arbitrary value;

$q_5 = 0.50$ arbitrary value.

If we consider all these tax cuts and credits we will obtain, using expression (A2), $P_x = 0.6026\, P_d$, which implies that the export price can be 39.74 percent below the domestic price.

Since it is very difficult to obtain accurate information to formulate hypotheses about all ts and qs, it is convenient to consider only t_1, t_2, and t^*, which are more easily obtained. In this case the relationship between the export and the domestic prices is given by:

$$P_x = \frac{1 - t_1}{(1 + t_2)\quad (1 + t^*)}\, P_d. \tag{A6}$$

Under the previous assumptions, $P_x = 0.6591\ P_d$, that is, the export price is 34.1 percent lower than the domestic price. Note that under this more simple computation we obtain about 85 percent of the total difference between P_x and P_d calculated in the more complete formulation. Certainly, the assumptions about other ts and qs affect the accuracy of this approximation, but we think that using only t_1, t_2, and t^* we will cover about 80 percent of that difference in the relevant range of variation of those variables.

Appendix C: A Model Relating Factor Market Distortions to Factor Utilization

To investigate the effects of factor market distortions on factor use, consider the industrial sector consisting of n subsectors and assume that there are two factors of production, capital (K) and labor (L), used to produce industrial product, x_i, under a production function homogeneous of degree one, such that $x_i = \phi_i\ (K_i, L_i)$. Let us assume, also, that each factor is paid by value marginal product in all subsectors, and that the factor supply elasticities for the industrial sector are given by ϵ_K and ϵ_ℓ.

Under the above assumptions, the production equilibrium in the industrial subsectors can be expressed by the following system (eq. A7):
Factor substitution in production (for $i = 1,2, \ldots, n$):

$$dlgK_i - dlgL_i = \sigma_i\ (dlgp_l + dlgt_{li} - dlgt_k - dlgt_{ki}).$$

Fixed output restrictions (for $i = 1,2, \ldots, n$):

$$K_i dlgK_i = L_i\, dlgL_i.$$

Factor market equilibriums:

(A7)
$$\sum_{i=1}^{n} k_i dlgK_i = \epsilon_K \, dlgp_k,$$

$$\sum_{i=1}^{n} l_i \, dlgL_i = \epsilon_\ell \, dlgp_l,$$

where

K_i = capital used in subsector i;

L_i = labor used in subsector i;

σ_i = elasticity of substitution between capital and labor in the production of subsector i;

$$k_i = \frac{K_i}{\sum_i K_i}; \quad l_i = \frac{L_i}{\sum_i L_i};$$

p_k = market rental value of capital in the industrial sector;

p_l = market wage in the industrial sector;

t_{ki} = distortions in the capital use as proportion of p_k in subsector i;

t_{li} = distortions in the labor use as proportion of p_l in subsector i;

ϵ = factor supply elasticities for the industrial sector.

If we consider that σ_i (for $i = 1,2, \ldots ,n$), ϵ_K, and ϵ_ℓ are known, we can solve (A7) given the actual use of factors (K_is and L_is) and the actual factor market distortions (t_{ki}s and t_{li}s), for the changes in K_is ($dlgK_i$), in L_is ($dlgL_i$) and in the factor market prices ($dlgp_l$ and $dlgp_k$). Thus, eq. A7 can be seen as a system of $(2n + 2)$ independent equations in $(2n + 2)$ unknowns, that is, $dlgK_i$ and $dlgL_i$ for $i = 1, 2, \ldots ,n$ and dp_k and dp_l. The system (A7) can be written in matrix form as:

(A8)
$$Bx = b$$

To obtain the solution for (A8) we need to supply the matrix B and the vector b. In specifying B, we need to provide information on K_i and L_i and impose values for σ_i, ϵ_K, and ϵ_ℓ. We consider the year 1970 and the twenty-one industrial subsectors, for the purpose of solving (A7), and taking the estimated values for σ_i from Macedo (1974); see column 5 in table 2.16. The values for K_i and L_i and consequently those for k_i and l_i are defined in terms of value, in such a way that they add up to the value added for sector i.

Since we have no information on the supply elasticities of capital and labor, we solve (A8) for different values of ϵ_K and ϵ_ℓ: Three assumptions

about ϵ_K and ϵ_ℓ are considered: (*i*) $\epsilon_K = \epsilon_\ell = \infty$; (*ii*) $\epsilon_K = \epsilon_\ell = 1$; and (*iii*) $\epsilon_K = 2.0$, $\epsilon_\ell = 1.0$. Section 2.3.3 of the text discusses the results in detail.

Notes

1. The interested reader is referred to Leff (1968) and Bergsman (1970) for more complete discussions of Brazilian economic development.

2. See also Villela and Suzigan (1973).

3. For more discussion of the trade regime, see Bergsman (1970), Baer (1965), and Fishlow (1975).

4. A recent study (Neuhaus and Lobato 1978) gives estimated ERPs for 1973 and 1975 for the more disaggregated (fifty-eight-activity) I-O classification used in section 2.4. These estimates could be grouped by trade category. They indicate a significant drop in effective protection in all categories since the earlier studies. Simple (unweighted) average ERPs for our trade categories in 1973 were 12 percent for exportables, 11 percent for importables, 18 percent for marginal trade items, and 12 percent for all manufactures. These low values make the estimates suspect, yet their magnitude suggests that protection has fallen considerably since the mid-1960s.

5. These benefits (not further discussed here) are associated with the simplification of exporting procedures; the marketing of Brazilian products abroad by the federal government; insurance against customer bankruptcies; special benefits to trading companies; sectoral programs; special incentives to foreign corporations to transfer operations to Brazil if they produce mainly for export; and tariff and tax exemptions on capital goods and raw materials imported by firms that have a pledge to export according to an approved plan.

6. In addition to IPI and ICM, other tax exemption measures include: (1) a drawback of import duties on all intermediate products entering into the production of an exported good (Decree-Law 53,967 [1964], extended by Decree-Law 37 [1968] and Decree-Law 68,904 [1971]); (2) rebates of other less important taxes on inputs, in the production and commercialization process of exports, like the tax on financial operation (IOF) and the tax on fuel and lubricants (IUCL); (3) exemption from import tariffs and other indirect taxes on machinery and equipment bought by firms that had a pledge with CACEX to export; and (4) exemption from income tax corresponding to export activities (Law 4,663 [1965], regulated by the Decree-Law 56,967 [1965]). For details, see Doellinger, Castro Faria, and Cavalcanti (1974); Fishlow (1975); Savasini (1975); Tyler (1976); and Castro Faria (1976).

7. Although the IPI and the ICM have been considered as value-added taxes, this is not always true, as we can see from the description of how they are applied and collected in chapter 4 of Carvalho and Haddad (1978). Since the main purpose of the tax reform that generated these two taxes was to avoid cascade taxing, a complete independent tax accounting system is necessary, and each firm has an accounting book for each tax.

8. The Resolução 71 was slightly modified recently by the Resolução 398 (December 1975), which unified all special credit programs granted to exports.

9. CACEX, or Carteria de Comércio Exterior, is the department of the Banco do Brasil that controls Brazil's foreign trade.

10. It is interesting to note that the computation with IPI tax rate equal to 0.08 produces results that almost coincide with independent estimates obtained by Fishlow (1975) and Savasini (1975).

11. The matrixes for 1959 and 1970 were constructed with data from the censuses of those years. The first one can be found in Rijckeghem (1969) and the second in IBGE (1976). The matrix for 1971 was constructed with data from the industrial tax (IPI) and is presented in Carneiro Leão et al. (1973). The matrixes are discussed in detail in Carvalho and Haddad (1978).

12. We call attention to the fact that the vectors of direct and total labor requirements on the two alternative definitions, value of production and value added, are highly correlated. The simple correlation coefficients between the vectors of direct and total requirements were equal to 0.92 and 0.95 for 1959, and 0.88 and 0.91 for 1971. Therefore the use of labor per value of production should not yield significantly different results, in relative terms, than labor per value added. Whenever the two calculations are made this is indeed the case, as we shall see below.

13. Estimates for 1970 using chapter 1's methodology are given in table 2.16. It should also be noted that labor requirements as estimated here encompass indirect labor only in the industrial sectors. The linkages with agriculture and services are not taken into account.

14. We have estimated that, *inclusive* of inputs from agriculture, the amount of employment attributable to exports of manufactures in 1970 was about twice that attributable to the production of import substitutes (i.e., 77.9 versus 34.7 per million cruzeiros of value of production). See Carvalho and Haddad (1978, chap. 6).

15. Lack of data for an alternative course imposes this procedure on us.

16. Labor coefficients for individual manufacturing sectors are thus implicitly weighted according to their share in the value of exports or imports. A logical alternative for inputs per unit of value added would be to weight according to the share of each sector in the value-added content of exports or imports.

17. West Germany, Belgium-Luxembourg, Denmark, France, Ireland, Italy, Netherlands, and United Kingdom.

18. Argentina, Bolivia, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, and Venezuela.

19. IBGE is working on a matrix for the agricultural sector, which will be completed in the near future.

20. This is not exactly true, since for some sectors at the two-digit level no subclassification is given. Therefore the matrix corresponds to a compromise between the two-digit and the three-digit classifications.

21. Twenty-one manufacturing sectors plus mining.

22. The categories for 1960 were (1) technicians and college graduates; (2) foremen (*mestres de contramestres*); (3) workers and apprentices; (4) other workers. For the 1970 census they were (1) technicians; (2) foremen and workers; (3) clerical workers. Rocca and Mendonca (1972) calculated an index in this fashion that is discussed in Carvalho and Haddad (1978, chap. 8).

23. The Two-thirds Law requires that two-thirds of a firm's labor force be Brazilian. Firms must report specific information giving nationality, skill categories, wages, education, and experience of their labor forces every April.

24. Obviously, schooling and job experience are not the only human capital content of the labor force, but other factors such as abilities and intelligence are not taken into account here.

25. The skill index for 1959 was obtained by first regressing the index of skill for 1970 on the sectoral wages paid and then applying those results to the wage structure of 1959.

26. Two observations in this context are in order. First, we are dealing here only with manufacturing. To the extent that exportables have more important linkages with the agricultural sector than importables, we should expect that the average skill content of exportables would fall relative to the one for importables once we take those linkages into account. Second, we are estimating skill content for importables produced with the Brazilian techniques, reflected in her input-output matrixes. It is perfectly possible, and probable, that import substitutes produced in Brazil are more labor-intensive and less skill-intensive than the same imports produced abroad.

27. Two studies analyze the existing regulations very carefully. One is Bacha, Mata, and Modenesi (1972), where the social security legislation is analyzed for its effects on labor absorption. The other is Kogut (1975), where the restrictions imposed on the use of labor at night and the effects on the possibility of industries adopting multiple shifts are analyzed.

28. This is the case of PIS (Program de Integração Social), the program that has as its main purpose a transfer of part of the profit to the labor force.

29. INPS is the Instituto Nacional do Previdencia Social, the agency responsible for administering the social security program in Brazil.

30. The rates on deposits at saving companies were fixed at 6 percent plus monetary correction, and the depositor also received a break in his income tax proportional to his average balance during the year, which increased the effective rate by at least two percentage points.

31. The rate of 10 percent plus monetary correction has been charged by the Financial Housing System to the general financing of home acquisition. For low-income housing the rate is smaller. Since the rate on bank lending has been kept under ceilings in the period 1965–75, we do not have evidence on the true market rates, which were higher than the ceilings owing to some widely used banking practices like the obligation of a minimum balance, a fee to open a credit line, and so on.

32. We are indebted to Arnold C. Harberger for suggesting this approach. Institutional barriers, high transaction costs, and the size of the industrial sector would justify the hypothesis of ϵ_K and ϵ_ℓ not being infinity.

33. As in the case of perfectly elastic factor supplies, the percentage changes applied were adjusted for the initial position, which is taken to be already distorted.

34. Since the firm has the option of either executing the drawback on tariffs paid on inputs or receiving the IPI and ICM credit premium on those inputs, it would opt for the drawback only if $t_4 > t^*$.

35. Elements (1) and (2) do not represent double-counting. Element (2) is a subsidy equal to the exempted tax.

36. As mentioned in note 34, if $t^* > t_4$, the firm will not take the drawback on imported inputs and t^* will be applied to P_x and therefore q_4 should be considered equal to zero in equation (A4) below.

References

Bacha, Edmar L.; Mata, Milton da; and Modenesi, Rui Lyrio. 1972. *Encargos trabalhistas e absorção de mão de obra: Uma interpretação do problema e seu debate.* Rio de Janeiro: IPEA.

Baer, Werner. 1965. *Industrialization and economic development in* Brazil. Homewood, Ill.: Richard D. Irwin.

Bergsman, Joel. 1970. *Brazil: Industrialization and trade policies.* Oxford: Oxford University Press.

———. 1975. Politica de comercio exterior no Brasil. *Estudos Econômicos* 5(2):51–104.

Carvalho, José L. 1975. O setor industrial brasileiro. Ongoing research project at FGV/EPGE. Preliminary draft.

Carvalho, José L., and Haddad, Cláudio L. S. 1978. Foreign trade strategies and employment in Brazil. Rio de Janeiro: EPGE/FGV. Mimeographed.

Carneiro Leão, Antonio Sergio; Silva, Carlos Ribeiro da; Giestas, Elcio; and Nobrega, José. 1973. Matriz de insumo produto do Brasil. *Revista Brasileira de Econômia* 27(3): 3–10.

Castro Faria, Hugo Barros de. 1976. Incentivos fiscais as exportações brasileiras. Ongoing M.A. essay at FGV/EPGE. Second draft.

Doellinger, Carlos Von; Castro Faria, Hugo Barros de; and Cavalcanti, Leonardo Caserta. 1974. *A politica brasileira de comércio exterior e seus efeitos: 1967/73.* Rio de Janeiro: IPEA.

Fishlow, Albert. 1972. Origens e consequências da substituição de importações no Brasil. *Estudos Econômicos* 2, no. 6: 7–75.

———. 1975. Foreign trade regimes and economic development: Brazil. Mimeographed. Paper presented at a conference in Bogotá, Colombia.

Haddad, Cláudio L. S. 1974. Growth of Brazilian real output, 1900/1947. Ph.D. diss., University of Chicago.

Instituto Brasilero de Geografia e Estatistica (IBGE). 1976. *Matriz de relações interindustrialis: Brasil.* Rio de Janeiro: IBGE.

International Monetary Fund. Various years. International Financial Statistics. Washington, D.C.: IMF.

Kogut, Edy Luiz. 1975. *Estudo sobre o uso de turnos de trabalho na industria de transformação do Brasil.* Rio de Janeiro: EPGE.

Langoni, Carlos Geraldo. 1973. *Distribuição de renda e desenvolvimento econômico do Brasil.* Rio de Janeiro: Expressão e Cultura.

Leff, Nathaniel. 1968. *Economic policy-making in Brazil, 1947–1964.* New York: Wiley.

Macedo, Roberto B. M. 1974. Models of the demand for labor and the problem of labor absorption in the Brazilian manufacturing sector. Ph.D. diss., Harvard University.

Mincer, J. 1974. *Schooling, experience, and earnings.* New York: Columbia University Press.

Neuhaus, Paulo, and Lobato, Helena Maria. 1978. Proteção efetiva a industria no Brasil, 1973–1975. Rio de Janeiro: Fundação Centro de Estudos do Comércio Exterios. Mimeographed.

Rijckeghem, Willy van. 1967. Tabela de insumo produto: Brasil 1959. Rio de Janeiro: IPEA. Mimeographed.

———. 1969. An intersectoral consistency model for economic planning in Brazil. In *The economy of Brazil*, ed. H. S. Ellis. Berkeley: University of California Press.

Rocca, Carlos A., and Mendonca de Barros, José Roberto. 1972. Recursos humanos e a estrutura do comércio exterior. *Estudos Econômicos* 2(5): 89–109.

Savasini, José Augusto A. 1975. A study of export promotion: The Brazilian case. Ph.D. diss., Vanderbilt University.

Senna, José Julio. 1975. Schooling, job experience and earnings in Brazil. Ph.D. diss., Johns Hopkins University.

Tyler, William G. 1976. *Manufactured export expansion in Brazil.* Tubingen: J. C. B. Nohr.

Villela, Anival V., and Suzigan, Wilson. 1973. *Politica do governo e crescimento da econômia brasileira.* Rio de Janeiro: APEC.

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