A STUDY OF THE STRUCTURE OF BRAZIL'S FOREIGN TRADE AND AN ANALYSIS OF HER PROTECTION AS RELATED TO THE EARNINGS OF INDUSTRIAL LABOR

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ABSTRACT

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As the title indicates, this study is divided into two parts. The first part examines empirically two theories widely used to explain trade patterns. According to the Heckscher-Ohlin model, the primary determinants of international trade flows are international differences in countries' relative endowments of capital and labor. Leontief's findings that United States exports are labor intensive compared to an equivalent amount of United States import replacements challenged the validity of this model. Leontief as well as Kenen, Keesing and others suggested that in the empirical estimation of relative capital and labor intensities of countries' exports and imports, differences in labor quality or embodied skill differentials should be added to the value of the "physical" capital. Since both the acquisition of "physical" capital and the possession of superior skills involves

acts of investments they could theoretically be combined. For this purpose the study uses Hal B. Lary's index of overall factor intensity, value added per man.

Chapter III determines the direction and composition of Brazil's commodity trade. Furthermore, the availability of "physical" and human capital is examined relative to Brazil's main trading partners, the industrial countries of North America and Western Europe. Chapter IV then tests a few of the "orthodox" theories of international trade. The hypothesis using skills or human capital to explain Brazil's trade flows performs better than the one using "physical" capital alone. Next, a special explanation of Brazil's exports of agricultural products is advanced. From Part One, I conclude that skilled labor is Brazil's most scarce factor of production.

Part Two deals with the structure of Brazilian protection relative to the factor intensities of her manufacturing industries. The hypothesis tested is whether Brazil's 1957 Tariff Law raised the earnings of the country's industrial labor. This would be the expected result from the Stolper-Samuelson theorem, which deals with the effect of a tariff on the earnings of the relatively "scarce" factor of production. Chapter VII tests this hypothesis within the framework of a linear model estimated by ordinary least squares. The estimated equations of the model indicate that the tariff and exchange premiums had an adverse protective effect. Instead of raising the earnings of industrial labor, the tariff and total protection in Brazil harmed it.

The last chapter examines some policy implications of this study, especially the validity of the claim that Brazil's future growth can be based largely on her exports of manufactured goods. Finally it is noted that to increase the international competitiveness of her industries, Brazil has to go further than simply lowering her tariffs. A thorough revision of the country's tariff structure, which considers her actual factor endowments, is necessary. Such a policy would enable the country to compete in world markets for manufactures along the lines suggested by the theory of comparative advantage.

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CHAPTER I

INTRODUCTION

The classical doctrine of International Trade dealt largely with the gains accruing to countries engaged in free trade along the lines suggested by the law of comparative advantage. However, that model was not adequate for a full analysis of the relationship between free trade and income distribution. A more complete discussion of this relationship became possible with the development of the Heckscher-Ohlin model.

The Heckscher-Ohlin model predicts that each country will tend to export the commodities that are intensive in its relatively abundant factor. Given the assumptions of the model, an increase in tariffs will have a predictable effect on the functional distribution of income. Stolper and Samuelson demonstrated convincingly that with unchanged terms of trade, a tariff will increase the relative price of the commodity that employs the scarce factor more intensively.[1] Thus, a tariff which raises the domestic price of the importable in relation to the domestic price of the exportable good will increase the returns to the "scarce" factor.

Metzler noted that Stolper's and Samuelson's conclusions have to be modified if one considers the effect of a tariff on the terms of trade and the resulting changes in income distribution.[2] Using a criterion developed by Lerner, he showed that a tariff will increase the domestic price of importables relative to exportables if and only if the foreign elasticity of demand <u>plus</u> the domestic marginal propensity to spend on importables is greater than unity.[3]

Metzler's insights into the possible effect of tariffs levied by Latin American countries on their domestic income distribution prompted this study. He observed that since world demand for Latin American exports of agriculture and mining products is presumed to be inelastic, a tariff is likely to improve these countries' terms of trade to such an extent so as to injure the region's scarce factor of production.[4] However, the relevant consideration for this study is whether the demand for <u>Brazil's</u> agricultural exports is inelastic and not whether <u>world</u> demand for these commodities is inelastic. (This question will be thoroughly discussed in the following chapters and Appendix A.) Although later writers have expounded and generalized Metzler's theoretical framework, it has not yet been tested empirically.

This study attempts to determine empirically the effect of Brazil's 1957 Tariff Law on the country's income distribution. However, before this problem can be investigated the structure of Brazil's foreign trade must be analyzed. Thus, the first part of the study is a test of the "neo-factor proportions" explanation of the structure of international trade. Specifically, I question whether Brazil's foreign trade conforms to the expectations based on the generalized factor proportions theorem.

Initially, it is necessary to determine the commodity composition of Brazil's exports and imports and the direction of her trade. In this context the country's "scarce" factor of production is defined, so as to know what to "expect" from her commodity trade. Brazil is relatively well supplied in "nature," i.e., natural resources (essentially soil and climate) combined with unskilled labor. Brazil's comparative advantage thus lies in commodities using this factor intensively in their production. These are agricultural crops such as coffee, cocoa, cotton and sugar which historically were the mainstay of the country's foreign exchange earnings.

Next, I examine whether Brazil, like many other underdeveloped countries, is most deficient in human capital (i.e., skilled labor) relative to her trading partners. Then Brazil would be expected to relieve her acute shortage of human capital by importing "skill" intensive goods from countries with an abundant supply of this factor. A test of this hypothesis is the subject matter of the first part of the study.

The second part of this study deals with the effect of the Brazilian tariff on the earnings of industrial labor. After establishing what the country's scarce factor is, I examine the structure of Brazilian protection, in particular, whether her tariff is so structured as to protect the country's scarce factor, skilled labor. This is carried out by devising an appropriate skill index for each major industry and then relating it to the country's structure of protection. Furthermore, the relationship between the inter-industry skill-mix and other industry characteristics (such as "physical" capital intensity) is analyzed.

The last part of the study examines the relationship between tariffs and earnings of industrial labor by testing the hypothesis that given the "correct" structure of protection (i.e., according higher relative protection to industries using the country's scarce factor intensively), Brazil's 1957 Tariff will raise the earnings of the country's skilled industrial labor as predicted by the Stolper-Samuelson theorem. I test this proposition by constructing a wage-determination model with the tariff included as one of the independent variables. The method of multivariate regressions analysis is used to determine the effect of various independent variables (among them the tariff) on the earnings of industrial labor. Finally, an interpretation of the regression results is advanced within the context of the entire study.

The study is divided into two parts. The first part (Chapters II-IV) includes an empirical test of different versions of the factor-proportions and skill-intensity hypotheses. The second part (Chapters V-VII) deals with the structure of protection in Brazil and its effects on the earnings of industrial labor; the latter section relies on the first part's conclusions regarding the structure of Brazil's foreign trade. Finally, Chapter VIII integrates the results from the first seven chapters and suggests certain conclusions to be drawn from the entire study.

FOOTNOTES: CHAPTER I

[1] W. F. Stolper and P. A. Samuelson, "Protection and Real Wages," Review of Economic Studies, IX (November, 1941), 58-73.

[2] L. A. Metzler, "Tariffs, the Terms of Trade and the Distribution of National Income," Journal of Political Economy, LVII (February, 1949), 1-29.

[3] A. P. Lerner, "The Symmetry Between Import and Export Taxes," Economica, III (August, 1936), 308-313.

[4] Metzler, op. cit., 23-25.

CHAPTER II

THE COMMODITY COMPOSITION OF TRADE: THEORY AND EMPIRICAL VERIFICATION

A. The Factor Proportions Theorem

The oldest and most widely studied explanation of the pattern of International Trade is the so-called factor proportions account or the Heckscher-Ohlin theorem.[1] In its simplest form the theorem is presented in terms of a two-country, two-commodity and a two-factor world. It postulates identical production functions across countries as well as similar consumption patterns internationally. Furthermore, it assumes that the production processes show constant returns to scale and diminishing returns throughout. Finally, if reversability of factor intensities is ruled out, the theorem demonstrates that the capital intensive commodity will be produced relatively cheaply in the capital abundant country, and similarly, the labor intensive good will be produced at lower cost in the labor abundant country. When trade ensues each country will export the good that it produces relatively cheaply.

The prediction of the Heckscher-Ohlin model that a country will export commodities which are intensive in its relatively abundant factor while importing commodities intensive in its relatively scarce factor were subjected to extensive empirical tests starting with Leontief's study.[2] Based on the United States 1947 Input-Output tables, Leontief computed the direct and indirect capital and labor required in the production of a given value of United States exports and of its import-competing goods. He found that a given value of United States exports embodied less capital and more labor than an equivalent amount of competitive imports. Since the United States has more capital per worker than any other major trading country, Leontief's results appeared to contradict the Heckscher-Ohlin theorem. Subsequently, certain writers have criticized the empirical foundations and more importantly, the methodological flaws inherent in Leontief's study.[3] Perhaps more significantly, as a result of his findings some of the rigid assumptions of the model were challenged and new and interesting avenues for investigation were opened.

In a recent study Hufbauer found that the export patterns of 24 countries at various stages of development can be explained by the Heckscher-Ohlin hypothesis, and also by the product cycle, returns to scale and product differentiation hypotheses. Hufbauer concluded: "Export patterns exercise an intriguing kind of selectivity. Commodities are favored which contain several characteristics [underlinings mine, T.C.L.] suitable to the nation's economic structure. The composite trading pattern thereby agrees with various theoretical predictions."[4]

It seems reasonable to distinguish between trade conducted among the advanced countries whose industrial base had developed over the last hundred years and trade between industrial and less-developed countries such as Brazil. Since the trade among the less-developed countries is insignificant quantitatively it can be ignored; in 1968 only 10 per cent of the less-developed countries exports of $32.3 billion was accounted for by trade among themselves. This ratio was on the decline since 1960 when it stood at 18 per cent.[5]

In explaining trade patterns among industrial countries it is appropriate to consider not only the factor proportions account, but also what Hufbauer called the "neo-technological" factors, i.e., scale economies and product age differentiation. For semi-industrialized countries (in Latin America these would include Argentina and Mexico as well as Brazil)--that also possess a small and unsophisticated industrial sector--the "neo-factor proportions" account, using physical and human capital, should be sufficient to explain their trade patterns.

B. Skills, Human Capital and the Commodity Composition of Trade

During the last decade several new theoretical approaches have been advanced to explain International Trade patterns. Among the early contributors was Kravis, who argued that the commodity composition of trade is mainly guided by the domestic "availability" (or the lack of it) of goods.[6] In investigating some 330 United States manufacturing industries, he found that industries exporting a high proportion of their domestic production pay higher average wages than industries that have a high ratio of imports to domestic production.[7] An explanation of Kravis' findings was advanced by Gary Becker in the context of his work on human capital. Becker suggested that the observed earnings of individuals tend to be related in an important way to their investment in themselves. This investment may be in the form of formal education, on-the-job training or informal ways of learning and improving oneself.[8] Thus, if the wage differentials observed by Kravis are the product of skill differences (i.e., investment in human beings) and if it is accepted that the United States has a relatively abundant supply of human capital, then United States export industries "ought" to pay higher wages than the import-competing industries because they employ more skilled workers.[9]

This approach was further developed by Kenen and some of its implications were spelled out.[10] In Kenen's model, land and labor constitute the country's "natural" endowment. Capital is an indirect factor of production; land and labor are inert until they are combined in production through the application of capital. Following the formal presentation of his model, Kenen suggested that the relative proportions of "human" and "tangible" capital embodied in commodities traded may be used to predict the structure of United States trade. In fact, given that the United States has a relatively plentiful supply of human capital, one would expect the United States to export products that are intensive in human capital.

Approaching the Leontief paradox from the standpoint of human capital, Kenen was able to estimate (roughly) the human capital requirements of United States trade. He assumed that skill differences among labor arise wholly due to the quantity of capital invested in people and that wage differences (ascribed to skill) reflect the gross return to that capital. Based on these assumptions he was able to estimate the capital that is required to convert a man-year of crude labor into a man-year of skill.[11] Then, using Leontief's own percentage distribution of skill, Kenen found United States export production to be intensive in human capital compared to United States import-competing commodities.[12]

Keesing, Waehrer and other members of the International Economics Workshop at Columbia University have centered their attention on the effect of labor skills or human capital on the structure of trade.[13] Specifically, they suggested that the category of factors aggregated under the term "labor" should be subdivided; ranging from unskilled to highly skilled (i.e., reflecting varying intensities of human capital). Predictions about trade patterns could then be made on the basis of the relative skill endowments of countries. This approach was adopted in part because of their dissatisfaction with the treatment of factors of production in the simplified Heckscher-Ohlin model.[14] Their criticism centered on the fact that natural resources were excluded from the "basic" model, as well as different qualities of the same factor of production, such as various skill categories of labor.[15]

To partly overcome these shortcomings, Donald Keesing attempted to incorporate into the Heckscher-Ohlin model different qualities of labor as separate factors of production.[16] He then proceeded to show that differences in the skill intensity of products are reflected systematically in the patterns of trade. In effect, he proposed to broaden the framework of the Heckscher-Ohlin model to include various grades of labor according to their skill classification instead of the theoretically convenient but operationally nebulous factor "labor."

Keesing outlined the rationale for the inclusion of varying grades of labor in explaining the location of industry and international trade patterns.[17] The first reason is the relative immobility of labor internationally as compared to capital and certain man-made material resources. Thus, the initial availability of what is essentially an immobile factor (labor) in a certain area is likely to influence the location of industry or production in that place. Because the movement of capital to the location of labor is usually cheaper than the reverse, one of the most pervasive influences on location of industry will be the skill characteristics of the local labor force. Probably the most important reason is the inherent difficulty in rapidly changing the skill characteristics of a labor force, assuming that such a transformation is a good substitute for free international movement of skilled labor. Keesing puts it as follows:

> The general training and experience of a population, together with its attitudes and working habits, resist rapid change. Therefore broad classes of skills in any population can only be altered slowly.[18]

Keesing's study used the ratio of skilled to unskilled labor in a two-factor, many-country model to reflect the differences in qualities of labor.[19] Using Leontief's skill calculations, he computed the skill content of 15 "footloose" manufacturing industries in the United States. The United States skill coefficients were in turn used to measure the skill intensity of exports and imports for the United States, seven European countries and Japan. By ordering the countries with respect to skill requirements in export production and similarly in import-competing production, Keesing found an almost perfect reversal of the ordering of countries. This led him to conclude that skill availability was a major factor in the determination of the structure of international trade.[20] The results of Keesing's studies strongly imply that the United States, being relatively well endowed in skilled labor, tends to export those goods which embody in their production a large proportion of skilled labor (its abundant factor).

Corroborative evidence is found in Hufbauer's study relating the skill endowments of 24 countries to the skill content of their commodity trade.[21] Notwithstanding the imperfections inherent in such international comparisons, the study obtained high Spearman Rank correlation coefficients between national skill endowments and skill characteristics embodied in traded manufactured goods. Noting the impressive explanatory power of the factor proportions account together with the human-capital theory, Hufbauer remarked that: ". . . a distressingly simple and orthodox formulation goes a long way to explain trade among manufactured goods."[22]

The first part of this study will investigate whether "physical" capital and labor skills availability "explains" Brazil's commodity composition of trade. Chapter III deals mainly with the question of "availability" of factors of production concentrating on the skill composition of the labor force and the capital-labor ratio in manufacturing.

In Chapter IV various tests are devised to investigate the explanatory power of the neo-factor proportions theory of international trade in manufactured goods. The role of Brazil's "natural" resources (defined as climate and soil conditions plus an ample supply of unskilled labor) is investigated to determine the country's revealed comparative advantage in agricultural commodities. In addition, an ad-hoc explanation of Brazil's manufactured exports is advanced within the context of the country's post World War II economic development.

FOOTNOTES: CHAPTER II

[1]For a fuller discussion of the theorem and its implications see: J. L. Ford, The Ohlin-Heckscher Theory of the Basis and Effects of Commodity Trade (New York: Asia Publishing House, 1965).

For a summary of the present state of the factor endowment theorem see: M. Michaely, "Factor Proportions in International Trade: Current State of the Theory," Kyklos, XVII (Fasc. 4, 1964), 529-49.

[2]Wassily Leontief, "Domestic Production and Foreign Trade: The American Capital Position Re-examined," Proceedings of the American Philosophical Society, XCVII (September, 1953), 332-49.

Further expounded in: W. Leontief, "Factor Proportions and the Structure of American Trade: Further Theoretical and Empirical Analysis," Review of Economics and Statistics, XXVIII (November, 1956), 386-407.

[3]See for example: Boris C. Swerling, "Capital Shortage and Labor Surplus in the United States?" Review of Economics and Statistics, XXXVI (August, 1954), 286-89, and M. A. Diab, The United States Capital Position and the Structure of Its Foreign Trade (Amsterdam: North-Holland Publishing Company, 1956).

For a succinct discussion of the various criticisms see: R. E. Caves, Trade and Economic Structure: Models and Methods (Cambridge, Mass.: Harvard University Press, 1960), pp. 273-80.

[4]G. C. Hufbauer, "Factor Endowments, National Size, and Changing Technology: Their Impact on the Commodity Composition of Trade in Manufactured Goods" (presented in an NBER Conference on Technology and Competition in International Trade, October 11-12, 1968, mimeo), p. 40.

[5]International Monetary Fund and International Bank for Reconstruction and Development, Direction of Trade (June, 1968 and November, 1969).

[6]I. Kravis, "Wages and Foreign Trade," Review of Economics and Statistics, XXXVIII (February, 1956), 14-30.

[7] *Ibid.*, 60.

[8] For details consult: G. S. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, National Bureau of Economic Research (New York: Columbia University Press, 1964), Chapters II and III.

[9] *Ibid.*, p. 60.

[10] P. B. Kenen, "Nature, Capital and Trade," *Journal of Political Economy*, LXXIII, No. 5 (October, 1965), 437-60.

[11] *Ibid.*, 456-57.

[12] *Ibid.*, 457, Table 5.

[13] Donald B. Keesing, "Labor Skills and the Structure of Trade in Manufactures," in *The Open Economy: Essays on International Trade and Finance*, ed. by Peter B. Kenen and Roger Lawrence, Columbia Studies in Economics I (New York: Columbia University Press, 1968), pp. 3-18, and Helen Waehrer, "Wage Rates, Labor Skills and United States Foreign Trade," in *The Open Economy: Essays on International Trade and Finance*, ed. by Peter B. Kenen and Roger Lawrence, Columbia Studies in Economics I (New York: Columbia University Press, 1968), pp. 19-39.

[14] For a complete discussion and in depth criticism of the model and the Leontief study see: Caves, *op. cit.*, 273-82.

[15] A consideration of the role of natural resources in United States trade is contained in: J. Vanek, *The Natural Resource Content of United States Foreign Trade 1870-1955* (Cambridge, Mass.: The M. I. T. Press, 1963).

[16] Donald B. Keesing, "Labor Skills and International Trade: Evaluating Many Trade Flows With a Single Measuring Device," *Review of Economics and Statistics*, XLVII (August, 1965), 287-94, also Donald B. Keesing, "Labor Skills and Comparative Advantage," *American Economic Association, Papers and Proceedings*, LVI, No. 2 (May, 1966), 249-58.

[17] Keesing, "Labor Skills and Structure . . .," *op. cit.*, 5-7.

[18] *Ibid.*, 6.

[19] Keesing, "Labor Skills and International . . .," *op. cit.*, 290-93.

[20] *Ibid.*, 291, Tables 1 and 2.

[21] Hufbauer's national skill coefficient includes only the "professional, technical and related workers" category of the ILO classification scheme. This excludes certain highly skilled employees such as managers, supervisory personnel and foremen. See: Hufbauer, *op. cit.*, p. 19.

[22] *Ibid.*, p. 20.

CHAPTER III

COMPOSITION AND DIRECTION OF BRAZIL'S COMMODITY TRADE AND HER FACTOR ENDOWMENTS RELATIVE TO HER TRADING PARTNERS

A. Direction of Brazil's Trade

1. Commodity Exports

Historically a small number of primary commodities have dominated Brazil's export trade. As late as 1964-66 coffee, cocoa, sugar, textile fibers, lumber and iron-ore constituted about 80 per cent of the total value of Brazil's exports. Following World War II the proportion of coffee, cocoa and cotton in total exports has declined steadily. In 1966-67, these three commodities accounted for 52 per cent of the value of Brazil's exports, a sharp decline from the 83 per cent existing in 1953-54.[1] The share of all major primary commodity exports declined from about 94 per cent in 1953-55 to about 79 per cent in 1964-66. The exports of only two commodities, sugar and iron ore, have increased in relative and absolute terms during that period. The most impressive performance among Brazilian exports was recorded by its manufactures exports (SITC 5, 6, 7, and 8). In 1960 exports of manufactured goods were about $21 million, or less than two per cent of all

TABLE 3.1.--Brazil's commodity exports as a proportion of total exports (based on dollar figures).

Period	Sugar and honey (SITC 061)	Coffee (SITC 071)	Cocoa (SITC 072)	Lumber (SITC 243.2)	Cotton (SITC 263)	Iron-ore and non-fer. base metals (SITC 281&283)	"Major" primary exports	SITC 0+1	SITC 0+1+2+3	SITC 5+6+7+8	Non-coffee exports
1953-55	.018	.637	.075	.030	.102	.022	.936	.778	.970	.009	.363
1956-57	.016	.653	.059	.034	.048	.042	.905	.789	.957	.014	.347
1958-60	.042	.562	.075	.035	.029	.062	.858	.765	.949	.017	.438
1961-63	.044	.522	.038	.030	.086	.073	.849	.688	.937	.030	.478
1964-66	.036	.470	.033	.033	.067	.078	.790	.652	.901	.068	.530

Notes: *Major primary exports include SITC categories: 05, 061, 071, 072, 211, 221, 243.2, 26, 281 and 283.

Source: See Data Appendix (Appendix D).

exports. In 1963-64 export of manufactures rose to $55 million or about 3.9 per cent of total exports, and by 1966-67 they grew to about $145 million annually or 8.5 per cent of the total.

The geographical distribution of Brazilian exports reflects the fact that primary commodities weighed considerably more than manufacturing exports in her export bill. During 1964-65 Brazil marketed 79 per cent of her total exports in industrial countries, with 34 per cent going to North America and 42 per cent to Western Europe. Only 11 per cent of total exports went to Latin America and about six per cent to Eastern Europe (see Table 3.2). Of the primary exports defined as SITC categories 0, 1 and 2, 81 per cent were marketed in non-Communist industrial countries; Latin America receiving eight per cent and Eastern Europe receiving six per cent were clearly of lesser importance. The main markets for Brazil's manufacturing exports in 1964-67 were: Latin America (48 per cent), North America (28 per cent) and Western Europe (13 per cent). During this period industrial countries accounted for about 46 per cent of Brazil's exports of manufactured goods.

In sum, Brazil's exports today as in the past are dominated by a small number of primary commodities. While industrial exports have grown rapidly in the 1960's, they contribute less than 10 per cent to the country's total

TABLE 3.2.--Geographic distribution of Brazil's exports by major commodities and SITC categories as a proportion of total exports, 1964-65.

	1	2	3	4	5	6	7	8
Exports	U.S. and Canada	Common Market	Western Europe	Japan	Total 1,3,4	Eastern Europe	Latin America	Other non-industrial countries
Coffee (SITC 071)	.463	.189	.397	.003	.864	.069	.039	.029
Cocoa (SITC 072)	.463	.110	.203	.029	.696	.157	.139	.007
Cotton (SITC 263)	.004	.523	.649	.113	.767	.070	.003	.160
Iron-ore (SITC 281)	.624	.121	.276	.054	.954	.021	.025	.000
SITC 0, 1 and 2	.347	.271	.442	.019	.808	.062	.083	.049
Chemicals (SITC 5)	.538	.116	.195	.012	.744	.034	.140	.070
Basic Manufactures (SITC 6)	.220	.088	.126	.045	.392	.012	.564	.030
Machines, Transport Equipment (SITC 7)	.041	.059	.071	.000	.112	.000	.857	.023
SITC 5, 6, 7 and 8	.230	.083	.124	.028	.383	.013	.565	.034
Total Exports	.344	.259	.425	.019	.789	.059	.113	.039

Source: Statistical Office of the United Nations, Department of Economic and Social Affairs, Commodity Trade Statistics (New York: United Nations, 1965 and 1966).

export earnings. The overwhelming share of Brazil's exports is marketed in industrial countries, especially in the United States and Western Europe. This proportion has been remarkably constant in the years following World War II (see Table 3.3).

2. Imports

Based on SITC categories Brazil's imports, in contrast to her exports, are fairly evenly distributed among the various import categories. This is in line with the proposition that countries tend to specialize in their exports while importing across the board. Table 3.4 presents the commodity composition of Brazil's imports for the 1953-66 period. Each SITC one-digit category conceals important differences in the movement of subaggregates within that category. With respect to fuels (SITC 3), the sharp rise in Brazil's domestic refining capacity over the past fifteen years has led to a marked increase in imports of crude petroleum (SITC 331) and a corresponding decline in imports of petroleum products (SITC 332).

In the late 1950's and mid-1960's between 56 and 63 per cent of all imports were manufactured goods (see Table 4). No clear trends can be discerned in the overall sample. The chemical and pharmaceutical industry has expanded rapidly during the period of investigation. From 1953 to 1963 the production of chemicals expanded eight fold; while the production of all manufactures expanded

TABLE 3.3.--Brazil's exports by main trading areas (as a proportion of total exports), selected years.

	1	2	3	4	5
Year	United States	Western Europe	Total 1 + 2	LAFTA countries	Latin America
1948	.433	.318	.751	.126	.135
1954	.370	.445	.815	.092	.093
1959	.462	.351	.813	.059	.060
1961	.401	.383	.784	.068	.070
1963	.377	.415	.792	.054	.060

Source: D. W. Baerresen, M. Carnoy, and J. Grunwald, Latin American Trade Patterns (Washington, D. C.: The Brookings Institute, 1965), p. 83, Table V-29.

TABLE 3.4.--Commodity composition of Brazil's imports (ratio of each SITC category imports to total imports), 1953-66.

	Food, bever-ages, tobacco (SITC 0&1)	Crude materials (SITC 2)	Mineral fuels (SITC 3)	Chemicals (SITC 5)	Manufactured goods (SITC 6)	Machines and trans. equip. (SITC 7)	Miscellaneous manufactures (SITC 8)	SITC 0+1+2	SITC 5+6+7+8
1953-55	.152	.041	.193	.089	.169	.298	.022	.198	.578
1958-60	.126	.042	.203	.093	.143	.369	.020	.167	.625
1964-66	.196	.036	.191	.142	.147	.242	.031	.233	.563

Source: See Data Appendix (Appendix D).

only 2.5 times. Yet chemical imports expanded both relatively and absolutely.[2] In 1964 chemical imports constituted about one-fifth of the industry's value added and in 1965, one-fourth.

By contrast, the proportion of "basic" manufactures (SITC 6) in the total import bill did not change significantly during the 1953-66 period. In this category the largest single imports were iron and steel (SITC 67) and nonferrous metals (SITC 681). These two products amounted to 8.7 per cent and 10.1 per cent of total imports in 1953-55 and 1964-66 respectively. Their share in total imports increased despite the rapid rise in domestic output of iron and steel. The output of steel ingots grew at 11 per cent per annum during the 1949-62 period.[3]

The imports of machinery and transportation equipment (SITC 7) were fairly widely distributed among the different three digit SITC groups in that category.[4] While the share of this group as a whole declined somewhat during the mid-1960's, the overall decline conceals considerable variation among its components. Commodity groups whose share in total imports rose were office machines and metal working machinery.[5] At the same time, a substantial decline was registered by the transportation group, especially motor vehicles (SITC 732), whose share in total imports declined from about 5 per cent in the mid-1950's to about 2.5 per cent in the first half of the 1960's.[6]

In 1964-65 about 87 per cent of Brazilian manufactured imports originated in industrial countries. North America provided about 36 per cent and Western Europe about 45 per cent of all manufactured imports. Only eight per cent of manufactured goods originated in other Latin American countries and five per cent in Eastern European countries. In contrast, the share of Latin America in <u>all</u> Brazilian imports in 1964-65 was about 23 per cent with industrial countries still the largest contributors with 64 per cent (see Table 3.5). Approximately 90 per cent of chemicals (SITC 5) and of machinery and transport equipment imports (SITC 7) originated in North America and Western Europe. Latin America's and other less developed countries' share in these relatively sophisticated products was below 5 per cent. The geographical distribution of basic manufactures (SITC 6) was less skewed, North America's and Western Europe's share was less than 60 per cent and Latin America and the less developed countries accounted for about 22 per cent.

Table 3.6 presents the pattern of Brazilian commodity imports in terms of geographical distribution over the fifteen years under investigation. During 1953-67, North America and Western Europe each contributed about one-third of total Brazilian imports. The only changes to note in Brazil's imports are a decrease in the relative share of Latin America and a doubling of the share of

TABLE 3.5.--Geographic distribution of Brazil's imports based on SITC categories as a proportion of total imports, 1964-65.

Imports	1 U.S. and Canada	2 Common Market	3 Western Europe	4 Japan	5 Total 1,3,4	6 Eastern Europe	7 Latin America	8 Other non-industrial countries
Food and Live Animals (SITC 0)	.424	.012	.083	.000	.507	.011	.481	.001
Crude Materials except Fuels (SITC 2)	.467	.144	.257	.002	.726	.007	.083	.182
Minerals and Fuels (SITC 3)	.152	.023	.024	.001	.177	.128	.372	.323
Chemicals (SITC 5)	.388	.351	.499	.014	.901	.039	.047	.013
Basic Manufactures (SITC 6)	.198	.199	.383	.108	.689	.085	.220	.006
Non-electric Machinery (SITC 71)	.353	.369	.535	.037	.926	.053	.020	.001
Electrical Machinery (SITC 72)	.364	.330	.481	.093	.938	.027	.032	.000
Transport Equipment (SITC 73)	.731	.109	.233	.020	.983	.010	.005	.000
Machines, Transport Equipment (SITC 7)	.429	.311	.466	.045	.940	.039	.020	.001
SITC 5, 6, 7 and 8	.359	.289	.452	.055	.866	.051	.078	.005
All Imports	.334	.168	.277	.030	.641	.056	.226	.076

Source: Statistical Office of the United Nations, Department of Economic and Social Affairs, Commodity Trade Statistics (New York: United Nations, 1965 and 1966).

TABLE 3.6.--Brazil's imports by main trading areas, as of total imports, 1953-67.

	1	2	3	4	5	6	7	8
Years	U.S. and Canada	Common Market	Western Europe	Japan	Total 1,3,4	Eastern Europe	Latin America	Other non-industrial countries
1953-55	.308	n.a.	.348	.032	.687	.024	.195	.095
1956-57	.344	n.a.	.321	.027	.692	.039	.174	.096
1960-63	.334	.197	.333	.041	.707	.050	.148	.095
1964-67	.360	.176	.292	.030	.682	.052	.181	.086
1960-67	.346	.187	.313	.036	.695	.051	.164	.091

Sources: United Nations, IMF, IBRD, Direction of International Trade, Volume years--1953-56 and 1956-59 (New York).

International Monetary Fund, IBRD, Direction of Trade, Volume years--1960-64, 1962-66 and June, 1968 (Washington, D. C.).

Eastern Europe. The general pattern followed by Brazilian trade is that of many other countries in early stages of economic development--whose commodity concentration of exports is considerably higher than those of imports.[7] During the 1964-67 period, only 65 per cent of Brazil's total imports originated in North America and Western Europe, yet 83 per cent of her manufacturing imports came from those sources.

B. Brazil's Factor Endowments Relative to Her Trading Partners

This part of the study inquires into Brazil's factor endowments in relation to her main trading partners. The identity of those partners has been established in Part A of this chapter. Generalizing from the Heckscher-Ohlin model, one can view the structure of trade as the outcome of the interaction between the production characteristics of commodities (with respect to "factor" intensity) and the countries' availability of these "factors." As was stated in Chapter II, I have chosen to test an "orthodox" version of the Heckscher-Ohlin model, i.e., one based on the national disparities in the availability of human and "physical" capital.

1. Human Capital

To approximate the availability of human capital in Brazil, I am presenting three indexes which together reflect Brazil's human resource level in relation to her trading partners. The Harbison index represents one attempt to quantify international differences of investments in skilled manpower. This index is calculated as a sum of two ratios: (a) students currently enrolled in secondary schools as a percentage of school-age population; and (b) students enrolled in institutions of higher education (colleges) as a percentage of school-age population, multiplied by a factor of five.[8] Another proxy for the stock of human capital was computed by M. E. Yahr.[9] Yahr obtained for several countries the mean educational level for males aged 15 and above. To obtain his educational index Yahr classified the male population over 15 by the level of their formal education and then weighed each educational class by the fraction of the male population in that educational group. The last measure was developed by H. Correa and it measures the physical capacity of a person to perform productive tasks.[10] Correa related the actual calorie intake of the countries' work force to the calorie requirements of the labor force for 100 per cent working capacity and thereby obtained an index of the "physical" capacity to work.

The evidence presented in Table 3.7 shows that in a sample of 12 countries (both developed and underdeveloped) Brazil ranks the lowest in its endowments of human capital, based on the Harbison and Yahr indexes. Based on the Correa index, Brazil ranks fourth (lowest) out of eleven

TABLE 3.7.--Levels of human resources for 12 countries by Harbison, Yahr and Correa indexes.

Country	Harbison index	Yahr index (school years per worker)	Correa index
Brazil	20.9 (1)	2.26 (1)	68.76 (4)
Paraguay	22.7 (2)	3.00 (3)	78.24 (6)
Mexico	33.0 (3)	2.96 (2)	60.26 (3)
India	35.2 (4)	n.a.	27.51 (1)
Chile	51.2 (5)	4.37 (6)	69.44 (5)
Argentina	82.0 (8)	4.13 (5)	93.46 (9)
Taiwan	53.9 (6)	3.66 (4)	n.a.
Sweden	79.2 (7)	n.a.	86.97 (7)
Canada	101.6 (9)	7.35 (7)	92.45 (8)
Japan	111.4 (10)	8.57 (9)	59.22 (2)
United Kingdom	121.6 (11)	9.45 (10)	97.50 (11)
United States	261.3 (12)	8.47 (8)	96.23 (10)

Notes: The numbers in parentheses indicate each country's ranking with respect to each index ((1) indicates the lowest, etc.).

Source: Merle I. Yahr, "Human Capital and Factor Substitution in the CES Production Function," in The Open Economy Essays on International Trade and Finance, ed. by Kenen and Lawrence (New York: Columbia University Press, 1968), p. 74, Table 1.

countries, but this index of "physical" capacity to perform work is a less appropriate measure of investment in human beings than the first two indexes.

In another context Anne Krueger used human capital or rather, three proxy variables closely associated with it, to "explain" over 50 per cent of the differences in income levels between the United States and several underdeveloped countries.[11] With respect to India she was able to conclude that of the actual per capita income differences between the United States and India <u>about two-thirds</u> are explained by the difference in their stock of human capital.[12] These estimates led Dr. Krueger to conclude:

> While many other factors, including the endowments of other resources are undoubtedly very important, the explanatory power of the human capital constellation of factors is impressive.[13]

The recent emphasis on human capital as an important explanatory factor of existing trade patterns also provides a useful insight into the sources of income differentials between rich and poor nations. The differences among rich and poor countries in their initial stocks of human capital are probably more pronounced than their disparities in physical capital or natural resources. In addition, the initial discrepancy among countries in their endowments of human skills may be propagated over time, due to the fact that skilled personnel is needed to train other skilled workers. In fact, the unequal distribution of highly trained personnel may be getting even more skewed due to the selective migration policies of industrial countries and especially the United States.[14]

2. The Skill Composition of Brazil's Labor Force Compared to Her Trading Partners

I have noted that Brazil ranks low in terms of her human resource development (as measured by the Harbison, Yahr and Correa indexes) not only relative to the industrial countries of Western Europe and North America but also compared to other LAFTA countries. Next, further evidence regarding the skill composition of Brazil's labor force will be presented. A comparison with the United States has been attempted because the data on the Brazilian labor force are most readily comparable to the occupational characteristics of the United States labor force as reported in the 1960 United States Census of Population. The following labor categories are classified as skilled: (1) Entrepreneurial, managerial and high administrative personnel; (2) Highly skilled professional personnel (especially engineers); (3) Subprofessional technical personnel (engineering assistants, technicians); and (4) Skilled workers (largely foremen and skilled craftsmen).

There is a dearth of accurate estimates of the industrial manpower supply in Brazil. I present two recent estimates, one for the country as a whole and the other for the city of Sao Paulo (see Table 3.8). This compares the occupational characteristics of the United States and

TABLE 3.8.--Occupational characteristics of United States' and Brazilian labor forces.

Skill Category	United States (1) Number	United States (1) Percentage of total labor force	Sao Paulo (2) Number	Sao Paulo (2) Percentage of total labor force	Brazil (3) Number	Brazil (3) Percentage of total labor force
Engineers	869,716	1.2	4,534	.40	11,000	.35
Technicians: Medical, Dental, Electrical, and Electronics	493,443	.72	4,169	.40	11,000	.35
Supervisory: Personnel Managers, proprietors, officials	5,488,933	8.0	n.a.	n.a.	33,000	1.10
Skilled workers: Foremen and kindred	9,250,569	13.6	224,188	18.8	546,000	18.20
Total Labor Force	68,006,553	100.0	1,193,583	100.0	3,000,000	100.0

(1)The United States data are from: U.S. Bureau of the Census, U.S. Census of Population: 1960, Subject Reports Occupational Characteristics, Final Report, PC (2)-7A (Washington, D. C., 1963).

(2)The data for Sao Paulo are from a manpower survey of industry carried out in June, 1964 by the National Industrial Apprenticeship Service. It is thus based on the country's largest industrial center with the greatest availability of skilled labor. See: Manuel Diégues, Jr., "Urban Employment in Brazil," International Labour Review, XCIII (June, 1966), 650.

(3)This is based on an estimate of the Brazilian trained manpower prepared by the Ministry of Education for the year 1963. See: A. B. Aráoz, "Manpower and Employment in Brazil," International Labour Review, XCIII (April, 1966), 381.

Brazilian labor forces, with respect to their skill composition. The evidence presented in Table 3.8 must be interpreted with great caution. This is especially true with regard to the catch-all category of "skilled workers." For Brazil the "skilled" category would include painters, maintenance men as well as toolmakers and electricians. In the United States one would consider the former unskilled and the latter skilled. Thus, the Brazilian data would overestimate the percentage of "skilled workers" in the overall labor force.[15]

Table 9 presents data on the availability of skilled workers in various industrial and Latin American countries based on the ILO classification system. Ratio A refers to the proportion of the economically active population that is included in ILO category "0" (professional, technical and related workers). Ratio B includes, in addition to category "0," workers included in occupational category "1" (administrative, executive and managerial personnel). Based on either ratio A or B (Table 3.9) it is evident that Brazil had a great shortage of skilled labor compared to North America and several Western European countries. For example, based on ratio A, the United States' and Canada's labor forces contain on the average three times as many skilled workers as the Brazilian labor force.

Appendix B presents some additional evidence on the availability (supply) of several highly skilled occupational categories in Brazil. This evidence points to the

TABLE 3.9.--Occupational characteristics of the labor force, various countries.

Country	Year of survey	Skilled employees as a per cent of the economically active population	
		Ratio A	Ratio B
I. NORTH AMERICA AND WESTERN EUROPE			
United States	1960	.108	.187
Canada	1961	.106	.183
Austria	1961	.068	.103
Belgium	1961	.080	.106
United Kingdom	1961	.086	.112
Germany	1961	.076	.107
Italy	1965	.053	.133
Netherlands	1960	.092	.123
Sweden	1960	.129	.150
II. LATIN AMERICA			
Mexico	1960	.036	.044
Chile	1960	.049	.068
Ecuador	1962	.033	.036
Panama	1960	.045	.066
Paraguay	1962	.032	.040
Peru	1961	.033	.048
Brazil*	1963	.037	.048

Notes: Ratio A is the per cent of skilled workers in category 0 (Professional, technical and related workers) as of total employees. Ratio B is the per cent of category 0 and 1 (administrative, executive and managerial) as of total employees. The data is from: International Labour Office, Yearbook of Labour Statistics 1966 (Geneva: ILO).

* = Brazil's ratio was extrapolated from the data on U. S. and Brazil in Table 3.8.

scarcity of skilled personnel at all levels, and especially of engineers and technicians. The slow expansion of engineering schools combined with a rapidly expanding demand for engineers resulted in very high salaries paid engineers relative to wages paid unskilled workers. (For details, see Appendix B).

The scattered evidence available on the supply of managerial and administrative personnel suggests a serious shortage of qualified and well-trained people capable of running modern enterprises. Finally, despite the rapid increases in the number of skilled workers available to industry in the post World War II years, serious shortages prevailed as reflected in the high relative wages of such workers (especially foremen).

Given the inadequacy of educational opportunities in Brazil and the shortage of facilities for the training of skilled workers, the skill composition of the country's labor force is likely to change very slowly in the near future.[16] Thus, relative to the industrial countries, the position of Brazil as a skill deficient country will be maintained in the foreseeable future.

3. Physical Capital

Compared to the information I presented on the availability of human resources, international comparisons of capital stocks are meager. Hufbauer estimated the capital stock per manufacturing employee of 22 countries.

His crude procedure involved adding up the current expenditures for manufacturing investment between 1953 and 1964 and then dividing by total manufacturing employment in 1964. No account was taken of inflation or depreciation of the capital stock.

Using a modified version of Hufbauer's procedure, I estimated the capital stock of Brazil.[17] (See Table 3.10). The evidence presented in Table 3.10 would qualify Brazil as a country "scarce" in physical capital relative to her trading partners of North America and Western Europe. However, I have to stress the rough nature of both Hufbauer's and my estimates.

To demonstrate how dependent are these types of calculations on the assumptions one chooses to employ, I calculated Brazil's capital-labor ratio in an alternative manner. From Clark and Weisskoff's study I obtained the gross fixed capital formation for the years 1953-64 at <u>constant</u> 1953 prices. This figure was converted into United States' dollars by using the mid-1958 period "general" category exchange rate (149.3 CR. per dollar). As a rule of thumb I assumed that 20 per cent of that figure is the value of gross fixed investment in <u>manufacturing</u>. I then deflated this by the 1964 transformation industries employment. As a result of this procedure the figure obtained for fixed capital per manufacturing employee was $840. This figure is not comparable to the

TABLE 3.10.--Estimation of capital stock and gross domestic product per capita in industrial countries and Brazil, 1964 (in dollars).

Industrial country	Fixed capital per employee in manufacturing	GDP per capita
Canada	8,850	2,002
United States	7,950	3,014
France	4,900	1,534
Belgium	4,400	1,458
Germany	4,250	1,541
Netherlands	4,750	1,264
Sweden	5,400	2,032
United Kingdom	4,000	1,480
Italy	2,100	916
Brazil	2,100	193

Sources: For industrial countries: G. D. Hufbauer, "Factor Endowments, National Size and Changing Technology: Their Impact on the Commodity Composition of Trade in Manufactured Goods" (National Bureau of Economic Research, New York, December, 1968, revised verson, mimeographed), Table 6, p. 77.

For Brazil: Data on gross fixed investment taken from: United Nations, Yearbook of National Accounts Statistics 1966 (New York: United Nations, 1967).

Exchange rates employed are from: International Monetary Fund, Annual Reports on Exchange Restrictions (various years).

Note: It was estimated that the share of manufacturing industries in gross capital formation was about 20 per cent. This is somewhat higher than the percentage used in connection with Brazil's three-year plan (1963-65). The figure used in the plan was 18.5 per cent. Thus, our estimate may be an upper limit of the "true" value of Brazil's capital stock. See: ECLA, "Fifteen Years of Economic Policy in Brazil," Economic Bulletin for Latin America (December, 1967), 206, Table 31.

calculations reported in Table 10. These estimates are only a rough indication of the domestic availability of Brazil's capital stock.

It is possible that Brazil's shortage of "physical" capital is not as acute as certain skills in her labor force. In the first place, the flow of capital internationally is much less inhibited than is the movement of labor across national boundaries. For instance, there was a considerable flow of capital in the form of direct investment from industrial countries into Brazil. Between 1955 and 1961 the flow of direct foreign investment alone into Brazil amounted to $714 million dollars.[18] Secondly, given the relative wage differential that exists between Brazil and the United States, the flow of human capital (i.e., skilled personnel) acts to worsen the initial discrepancy in skill availability between the two countries.

In this chapter it has been established that Brazil suffers from a great dearth of skilled labor in relation to her cheif trading partners, based on two ratios of skill "availability." Because of the conceptual and statistical problems involved in estimating the country's stock of "physical" capital the shortage of this factor has been less accurately determined. Overall, it has been established that the country is capital (both human and "physical") poor, relative to the industrial nations of North America and Western Europe.

Based on these findings, Chapter IV will examine Brazil's commodity trade using certain versions of the factor proportions model.

FOOTNOTES: CHAPTER III

[1]Computed from sources in Data Appendix.

[2]All the data from which these calculations were derived are in the Data Appendix.

[3]Calculated from: Survey of the Brazilian Economy 1965 (Washington, D. C.: Brazilian Embassy, 1966).

[4]The imports of SITC 7 commodities averaged about $277 million in 1964-65. The breakdown within that category was as follows (each three-digit SITC group as a percentage of all SITC 7 category):

Power machinery, non-electric (SITC 711)	9.0 per cent
Agricultural machinery (SITC 712)	2.0 per cent
Office machines (SITC 714)	5.5 per cent
Metal-working machinery (SITC 715)	9.6 per cent
Textile, leather machinery and machines for special industries (SITC 717 and 718)	12.0 per cent
Other non-electric machines (SITC 719)	20.9 per cent
Electrically powered machinery and electricity distributing machinery (SITC 722 and 723)	8.7 per cent
Other electrical machinery (SITC 724, 725 and 729)	9.6 per cent
Railway vehicles (SITC 731)	4.2 per cent
Road motor vehicles (SITC 732)	9.4 per cent
Aircraft (SITC 734)	4.0 per cent
Total of above	95.8 per cent

Calculated from: United Nations, Commodity Trade Statistics, 1964 and 1965, Series D., Vols. XIV and XV (New York: United Nations, 1965 and 1966)

[5]The imports of office machinery were less than $4 million in 1953; in 1966 they amounted to $23 million. See Data Appendix.

[6]The imports of motor vehicles averaged about $110 million during 1957-59; in 1963-65 they fell to about $28 million per annum. Large scale domestic production of motor vehicles began in 1957.

[7]M. Michaely, Concentration in International Trade (Amsterdam: North-Holland Publishing Company, 1962), pp. 31-36.

[8]F. Harbison and C. A. Myers, Education, Manpower, and Economic Growth: Strategies of Human Resource Development (New York: McGraw-Hill, 1964), pp. 31-32.

[9]Merle I. Yahr, "Human Capital and Factor Substitution in the CES Production Function," in The Open Economy: Essays on International Trade and Finance, ed. by Peter B. Kenen and Roger Lawrence, Columbia Studies in Economics I (New York: Columbia University Press, 1968), pp. 31-32.

[10]H. Correa, The Economics of Human Resources (Amsterdam: North-Holland Publishing Company, 1963), pp. 30-34.

[11]Anne O. Krueger, "Factor Endowments and Per Capita Income Differences Among Countries," Economic Journal, LXXVIII (September, 1968), 641-55.

[12]Ibid., 650-51, Table II.

[13]Ibid., 656.

[14]Between 1962 and 1966, 466 Brazilian scientists, engineers and physicians immigrated into the United States. In 1962 Brazilian universities graduated 60 scientists (Ph. D.'s) of which 13 (22 per cent) immigrated to the United States. U. S. Congress, The Brain Drain into the United States of Scientists, Engineers and Physicians (Washington, D. C.: A Staff Study for the Research and Technical Programs Subcommittee of the Committee on Government Operations, July, 1967), p. 7, Table VII.

[15]A study by Nathaniel Leff presents somewhat different view with respect to skill requirements of capital equipment producing industries. As regards the use of skilled labor in the capital goods sector, Leff found that the lack of formal education (visa via the United States labor force) did not seriously hamper them in carrying out their often technically exacting tasks. Based on interviews conducted by Leff it appears that three or four years of formal schooling was all that was generally required for semi-skilled workers in that sector. In the case of foremen, five to six years of schooling was sufficient.

In contrast, the median school years completed by foremen in the United States manufacturing industries was 11.8 years, i.e., a high school equivalency. Based on Leff's study we can conclude that at least in certain skilled occupations (especially category 4) there is considerable leeway in terms of the formal educational requirements of the labor force.

See: N. H. Leff, The Brazilian Capital Goods Industry, 1929-1964 (Cambridge, Mass.: Harvard University Press, 1968), pp. 46-49.

16 In Brazil several vocational training activities exist that are administered by the government or by the employers. SENAI (National Industrial Apprenticeship Service) offers a variety of training programs for the young and for adults usually in evening classes. See: W. B. Dale, Brazil/Factors Affecting Foreign Investment (Menlo Park, Calif.: International Industrial Development Center, Stanford Research Institute, 1958).

17 The main difference between Hufbauer's calculation and ours involves the use of exchange rates. Hufbauer used mid-period (i.e., generally 1958) exchange rates to convert local currency units into U. S. dollars. Our procedure used the average of import category exchange rates (since the multiple exchange rates were in effect in Brazil) to convert the annual data on Brazilian capital formation. This procedure is better suited to take account of the rapidly depreciating Brazilian currency resulting from the domestic inflation.

For comparison to Hufbauer's method see: Hufbauer, op. cit., pp. 77-80, Table 6, and P. G. Clark and R. Weisskoff, "Import Demands and Import Policies in Brazil," U. S. Agency for International Development, February, 1967 (mimeo), Table C-2, p. 50 and Table B-5B, p. 45.

18 N. H. Leff, Economic Policy-Making and Development in Brazil, 1947-1964 (New York: John Wiley and Sons, 1968), Table 13, p. 61.

CHAPTER IV

THE FACTOR COMPOSITION OF BRAZIL'S TRADE

A. Exports and Imports of Manufactures

In Chapter III it has been established that the bulk of Brazil's trade is conducted with the industrial countries of Western Europe and North America. It has been shown that Brazil is deficient in human capital (skilled labor) and to some extent in "physical" capital relative to her main trading partners. Brazil's most abundant "factor" is the combination of her plentiful natural resources and her unskilled labor.[1] In this chapter, I wish to inquire whether Brazil's commodity composition of foreign trade conforms to what would be expected from her factor endowments.

For the most part, this chapter will test two "orthodox" theories of the commodity composition of trade. One is the simple factor endowment account, which uses the "physical" capital intensity of manufactured goods. The Heckscher-Ohlin model focused attention on international differences in countries' relative endowments of capital and undifferentiated labor as the primary explanation of International Trade. The other is the human capital or skill-intensity explanation of trade. In certain instances the human and "physical" capital intensities have been combined into one "overall" measure of man-made resources.

1. "Direct" Test of the Factor Proportions Theorem and the Human-Skills Hypothesis

One possible testing procedure is to use Brazil's Inter-Industry Transaction Table to compute the direct and indirect capital and labor requirements of Brazil's exports and import-replacements. This would constitute a direct test of the original version of the factor proportions model along the lines suggested by Leontief's celebrated study, and later applied to United States trade with Japan and India.[2] While I understand that an Inter-Industry Transaction Table is presently being constructed for Brazil and will be available for future research, it was not available at this time.

In lieu of Leontief's procedure, I used the United States factor composition of traded commodities (based on two or three digit SITC) that were computed by Hufbauer and applied them to a matrix of Brazil's 1966 export and import trade.[3] This procedure assumes that the rankings of commodities produced in the United States, based on capital per employee, skill ratios and wages per worker, can be applied to Brazil, i.e., that no factor intensity reversals occur.[4]

Although several writers expressed considerable skepticism as to the empirical significance of the factor intensity reversal phenomenon, I nonetheless tested for this theoretical possibility within the limitations imposed by my data.[5] Specifically I used the Rank correlation technique to ascertain whether the pattern of United States industries' factor intensities can be applied to Brazil. In comparing factor intensities across industries, I adopted Lary's concept of "overall" factor intensity based on value added per employee and its breakdown into the wage and salary component and the non-wage value added "residual."[6] Further elaboration of these concepts is contained in part A-2 of this chapter.

The highest Spearman (Rank) correlation coefficient of .841 was obtained when United States and Brazilian industries were ranked based on wages and salaries per employee. If it is agreed that industries paying higher than average wages may be characterized as skill intensive, we ought to reject the existence of any "skill reversals" between United States and Brazilian industries. A somewhat lower Spearman correlation of .735 resulted when the comparison was based on the industries' "overall" factor intensity. And finally, the lowest coefficient, .694, was obtained using the non-wage value added, i.e., the proxy for "physical" capital intensity across my sample of 20 industries. All three coefficients were easily significant at the one per cent level. Thus, this evidence leads us to conclude that factor-intensity reversals (and especially "skill" reversals) are not of empirical importance even in this case.

Having disposed of this possible objection, I then proceeded to use the American capital-labor ratios, skill coefficients and wage rates to compute the embodied characteristics of Brazil's foreign trade in manufactured goods. My results are presented in Table 4.1.

The evidence summarized in Table 4.1 conforms to a priori expectations based on Brazil's relative factor availabilities; i.e., Brazil's imports of manufactured goods have more capital and skilled labor embodied in them than her exports of manufactures. This results from the preponderance of above-average capital and skill intensive goods in Brazil's imports bill relative to her exports. For instance, Brazil's 1966-67 imports of the highly capital and skill intensive commodity group--Chemical Elements and Compounds (SITC 51)--averaged about $113 million or about seven per cent of total imports. Brazil's exports of the said commodity group were only $16 million a year, less than one per cent of Brazil's 1966-67 exports. In contrast, in 1966 Brazil exported $8.5 million worth of leather (SITC 611), which comprised one-half of one per cent of her total exports. At the same time, Brazil imported less than $.2 million of this

TABLE 4.1.--Embodied characteristics of Brazil's imports and exports of manufacturers, 1966.

	Capital per man	Skill ratio	Wages per man
Imports of manufacturers	$9224.5 ($9457.2)	.067	$3948.2 ($4018.9)
Exports of manufacturers	$1077.2 ($1000.5)	.0058	$ 439.3 ($ 444.0)

Notes: The characteristics of 1966 exports and imports were based on three-digit SITC trade data figures except in case of the skill ratios where the two-digit SITC category was used. The figures in parentheses were calculated based on the two-digit classification.

The embodied characteristics were obtained in each case by multiplying a given commodity characteristic (e.g., skill ratio) by the percentage of Brazil's exports (or imports) of that commodity and summing it up over all three digit (or two digit) commodities.

Source: Characteristics of trade goods were obtained from: G. C. Hufbauer, "Factor Endowments, National Size and Changing Technology: Their Impact on the Commodity Composition of Trade in Manufactured Goods" (presented in an NBER Conference on Technology and Competition in International Trade, October 11-12, 1968, mimeographed), Table 3.

Brazilian trade data were taken from: United Nations, Commodity Trade Statistics 1966 (New York: United Nations).

commodity that is characterized by low skill content and low capital intensity.[7]

While these findings conform to a priori expectations, given Brazil's factor endowments relative to her trading partners, they do not constitute a "strong" test of the factor proportions theorem. In the first place, while I rejected the possibility of general factor intensity reversals, some factor substitution is likely to take place. Given the serious shortage of human capital (i.e., skilled labor) in Brazil, there will probably be some substitution of unskilled labor (and possibly also "physical" capital) for skilled labor. Thus, the use of American capital and skill coefficients in lieu of Brazilian factor intensities in production of traded commodities may "overstate" my case somewhat.

Secondly, while virtually all of Brazil's imports of manufactured goods originated in industrial countries, no such clear-cut division exists in the destination of her manufacturers exports.[8] In 1964-67 about 42 per cent of these exports were directed to Western Europe, United States and Canada, with somewhat over one-half going to Latin America and other less developed countries. Given that Latin American countries have roughly similar endowments of capital and skilled labor, the trade among them in manufactured goods is the likely result of various locational factors as well as tariff concessions granted within the framework of LAFTA.[9]

Based on two-digit SITC categores, I next computed the proportion of Brazil's imports and exports of manufactures that originated in or was destined to the markets of Western Europe and North America.[10] Using the rank correlation test I then compared these ratios to the characteristics of the traded commodities, with respect to capital per man, skill ratios and wages per man. The results of this test are reported in Table 4.2.

TABLE 4.2.--Rank correlation test of Brazil's commodity trade characteristics and the direction of her trade.

	Industrial countries' proportion in Brazil's manufacturers imports (1966)	Industrial countries' proportion of Brazil's total manufacturers exports (1966)
Capital per man	.450** (t = 2.523)	-.028 (t = .143)
Skill ratio	.500* (t = 2.883)	-.119† (t = .600)
Wages per man	.575* (t = 3.514)	.127 (t = .022)

Note: * Significant at the one per cent level.
** Significant at the two per cent level.
† Significant at the 30 per cent level.

Source: Data on commodity characteristics are from: G. C. Hufbauer, "Factor Endowments, National Size and Changing Technology: Their Impact on the Commodity Composition of Trade in Manufactured Goods" (presented in an NBER Conference of Technology and Competition in International Trade, October 11-12, 1968).
Brazilian trade data are from: United Nations, Commodity Trade Statistics 1966 (New York: United Nations, 1966)

Table 4.2 ranks commodities based on their human capital intensity. As is theoretically expected the more skill intensive a given commodity, the higher the proportion of that commodity that will be imported from the human capital abundant countries of Western Europe and North America (i.e., one would expect the Spearman Rank to be positive and significant with respect to imports). When analyzing the results of this test, the reader must bear in mind that over 80 per cent of Brazil's manufactures imports originate in the industrial countries of Western Europe, United States and Canada. The tests summarized in Table 4.2 confirm to the hypothesis that Brazil's imports of manufacturers included a high proportion of commodities that are intensive in "capital" conceived in a broad sense to include not only the material means of production but also human skills. Yet based on this test we are unable to discriminate between the "physical" and human capital explanations of the structure of Brazilian trade. It is also evident from Table 4.2 that the human and physical capital intensities did not provide a satisfactory explanation of Brazil's patterns of manufactures exports. (In two cases the coefficients are negative as one would expect, but insignificant at the customary level.)

This later result is not entirely unexpected since Brazil's exports of manufactured goods were largely a by-product of the evolution of her manufacturing sector, through the process of import substitution. The expansion and growth of the industrial base during the post World War II period was stimulated by means of various incentives and subsidies and in particular, the exchange and tariff privileges granted industries during the 1950's.[11] Given the importance of domestic market size in the process of industrialization through import substitution, exports of manufactures have been viewed by Brazilians as an outlet for that part of the output that could not be accommodated domestically. Investment in local production was undertaken without regard to the future feasibility of exporting these goods and with the knowledge that the domestic market was "secured" through protective policies adopted by the government.

The textile industry in Brazil is a case in point. For more than half a century the Brazilian cotton manufacturing industry enjoyed the privileged status of an "infant" shielded by a high protective wall. Brazil's textile industry was one of the earliest established in Latin America and the country has almost achieved self-sufficiency in textiles, wool products and certain man-made fibers. Yet in 1965-66 exports of textiles (SITC 65) averaged only $15 million, just about one per cent of domestic production. In a detailed study of the industry Stein pointed out: "As long as manufacturers could sell production at home and the 'excess' abroad they could operate successfully without truly competitive conditions arising."[12] And the industry's view of exports has been stated by Stein as follows: ". . . manufacturers agreed that exports constituted a method to carry the industry until the level of domestic consumption were raised by measures involving all sections of the economy."[13] Brazil's "exportable surplus" approach to International Trade helps "explain" the lack of any clear-cut results in Table 4.2 concerning exports of manufactures.[14] Analysis of Brazil's non-manufacturing exports is taken up separately in the last part of this chapter.

2. Brazil's "Revealed" Comparative Disadvantage and the Industries' Factor Intensities

In this section a different set of tests will be devised to analyze the competitive performance of Brazil's industries in international markets. This part differs from Section 1 of this chapter on two important points. In the first place, I deal with industries' performance [with respect to exports and/or imports] rather than with individual commodities. And secondly, a fuller complement of industry characteristics has been devised. I will deal with each of these questions in turn.

Numerous measures can be developed in order to gauge the international competitiveness of an industry (e.g., the time trends of exports and imports or comparative production costs). In this study, one measure used is the trade balance (i.e., imports less exports of two-digit SIC industries) as a ratio of the value of industry's domestic sales. Presumably, those industries in which Brazil had <u>no</u> comparative cost advantage internationally would rank high based on this index of competitiveness and vice versa. As a complementary indicator I computed the ratio of imports to exports for each industry. Both ratios would thus rank Brazil's industries on their ability to compete in foreign markets and on the extent of penetration of other countries' exports into the domestic market.

Analysis based on the trade balance as a measure of comparative advantage suffers from the known deficiency of being affected by tariffs and quotas in the importing countries.[15] These may understate Brazil's cost advantage in certain labor intensive products, which also may be taking advantage of cheap domestic sources of raw materials. It is of interest to note that almost all of the industries that were net exporters in 1965 were crucially dependent in their production on the local availability of cheap and plentiful sources of raw materials. Lumber (net exports of $62.7 million), leather (net exports of $4.5 million) and textiles (net exports of $13.5 million) are cases in point.

To establish the industries' factor intensities the following variables were used: Value added per employee, two measures of the skill content of each industry, and a proxy for the capital-labor ratio. Following the work by Hal B. Lary, value added per employee has been used as a satisfactory measure of the flow of human as well as "physical" capital into the manufacturing process.[16] Using the flows of man-made resources into the industries' output, value added per employee is taken as an indicator of the "overall" factor intensity of an industry. The theoretical justification for this approach has been advanced in another context by Peter B. Kenen. Kenen treats the country's natural resources--unimproved land and completely unskilled labor--as inert inputs that must be "activated" through investment in order to be used in production.[17] In this context value added per employee can be used as a single measure of the aggregate flow of man-made resources into the production activities of an industry.

Since one part of the value added can be attributed to human capital, it is imperative that an appropriate measure of industries' "skill content" or human capital intensity be designed. The theoretical underpinning of this approach has been established by Schultz and Becker in their innovative work on human capital.[18] Becker and Schultz maintain that differences in occupational earnings can be attributed to differences in the amount of training required by various occupations. Investment in human beings is usually referred to by the catch-all phrase "training." It includes formal and technical education as well as on-the-job training. The individual who pays for some or all of the costs involved in improving his skill would have increased his lifetime earnings stream more than the person with less training.[19] Assuming that workers in "skilled" occupations incur greater costs of investment in themselves than "unskilled" workers, the "skilled" worker should receive greater absolute earnings than those received by the "unskilled" workers.

To test whether there is a relationship between the inter-industry skill composition and the industries' competitive performance, one must first devise a meaningful measure of the industries' skill mix; that will be referred to heretofore as the "skill-index." Mrs. Helen Waehrer constructed such a measure of industry's skill in her study of the wage structure of export and import-competing industries in the United States.[20] Her "occupational index" was defined as the percentage of employees in each industry, out of all employees, falling into six occupational groups designated as skilled.[21] Mrs. Waehrer found a significant positive correlation between her index of skill and earnings of labor in foreign trade oriented industries.

The Waehrer index regrettably suffers from limitations as a measure of skill or as a proxy for human capital. Specifically, it will vary from industry to industry only with differences in the distribution of employees defined by her as "skilled" and those defined as "unskilled." This will conceal wide variations in skill content within each of the broad categories of skilled workers. As an illustration, suppose that two industries rank equally in terms of Waehrer's skill index; but one of the industries has a higher proportion of managers and engineers, while the second industry has an equally large proportion of sales and clerical personnel. Clearly, from the standpoint of human capital intensity, the first industry should rank higher than the second; however, this will not be reflected in the Waehrer skill index, because of her definition of "skilled workers."

To avoid these deficiencies I have constructed for Brazil a weighted skill index, where the weights are the earnings of workers in each skill-category. Skill index-I is defined as the percentage of earnings in each industry going to workers classified as skilled, out of total earnings of employees in that industry. The classification of workers into "skilled" or "unskilled" categories is somewhat similar to that of Mrs. Waehrer. Unfortunately, the Brazilian Industrial Census of 1960 includes a breakdown of earnings in 20 major industries only according to broad occupational classes. The three classes defined in the Brazilian Census are: Class A--professionals and technical workers; Class B--"other employees," that includes directors and managers, office personnel and other service personnel; Class C--workers directly involved in production, including operators and kindred workers, as well as foremen and apprentices.[22]

I defined skilled workers as those belonging to Classes A and B, above. Skill index-I admittedly does not allow for a detailed enough breakdown of occupational classes. Some employees included in Class C and therefore classified as unskilled should really be included in the skilled category. Specifically, foremen whose overall training includes a considerable amount of technical schooling and on-the-job training should be classified as skilled laborers. On the other hand, a number of service workers belonging to Class B and classified therefore as skilled should really be reclassified in the unskilled category. Category B includes in part custodial services workers, porters and typists whose training requirements are minimal. Table 4.3 shows that these reservations with regard to skill index-I are well founded. The average monthly salary of a foreman who was classified as "unskilled" is more than twice the salary of a typist or a file clerk that I involuntarily classified as "skilled," due to the inadequate breakdown in the census classification.

TABLE 4.3.--Average monthly wages and salaries paid by United States companies in the Sao Paulo area in June, 1959.

Function or occupational category	Wages and salaries in cruzeiros
Engineer	38,326
Personnel manager	33,905
Accountant	33,222
Salesman	25,118
Billing supervisor	16,995
Typist (Portutuese only)	8,101
File clerk	7,706
Foreman	20,362
Mechanic	11,734
Skilled laborer	9,583
Packer	8,360
Unskilled laborer	5,900

Source: Gordon and Grommers, United States Manufacturing Investment in Brazil 1946-1960 (Boston: Harvard University, 1962), p. 119, Table 18.

Based on these considerations I devised a different skill index that resolves some of the aforementioned difficulties. From the Brazilian census data I got the number of employees in each industry group that can be classified as skilled based on their actual earnings.[23] Based on Table 4.3, I decided to use the salary of CR 9,000 per month as the cut-off point. That is, employees earning above this salary would be classified as "skilled" and those falling below this as "unskilled." The members of the following occupations were consequently classified as skilled: Engineers, managers and accountants, salesmen, billing supervisors, foremen and "other" skilled workers.

I defined skill index-II as the percentage of those employees in each industry that earned in excess of CR 9,000 per month, or fall into the occupational categories listed above. Furthermore, I computed skill index-III: The percentage of employees in each industry that earn more than CR 15,000 per month.[24] Skill index-III includes the members of occupational groups previously listed, with the exception of those classified as "skilled" laborers and mechanics. This gave me yet another measure of the human capital content of each major industry group corresponding to the occupations with the highest skill level. Because of the deficiencies in skill index-I as a measure of human capital, I was not surprised to find that the rankings of Brazilian industries based on the three measures of skill do not correspond very closely. The Spearman Rank correlation coefficients between skill index-I and skill indexes-II and III were .651 and .697 respectively; both significant at the one per cent level.

The last variable measures the "physical" stock of capital per employee in each industry. Aware of the known pitfalls encountered in measuring the stock of capital, I used as a proxy for this variable the horse-power per employee in each industry. As a test of the extent of linear association between the two sets of variables, the

Spearman Rank correlation coefficients were used. Another measure of the degree of conformity is provided by Kendall's Coefficient of Concordance.[25] (See Tables 4.4 and 4.5.)

The results in Tables 4.4 and 4.5 are in accord with the previous findings that in relation to her trading partners, Brazil's factor deficiency is most pronounced in human capital (i.e., skilled labor). Consequently, Brazil was compensating for its scarcest factor by importing from Western Europe and the United States those commodities that contained a high proportion of human capital. My results are the more convincing because they are based on several different ratios of an industry's trade performance, i.e., the industry's exports, imports and the trade balance. The high coefficients of concordance with respect to the skill ratios are impressive. Thus it is possible to state that the comparative <u>dis</u>advantage of Brazil is most pronounced in the manufactured commodities requiring a great deal of skilled labor in their production. Physical capital intensity and the "overall" factor intensity, based both on material and human capital, did not perform as well in "explaining" Brazil's trade patterns.

While Brazil's comparative <u>dis</u>advantage has been established, the question of her comparative advantage has not yet been considered. Given the abundance of certain "natural" resources, i.e., climate, soil and

TABLE 4.4.--Correlation coefficients of Brazil's trade performance and industry characteristics, 1966.

A. Spearman Rank Correlation Coefficients

	Industry Characteristics[a]			
	Skill Index-II	Skill Index-III	Horsepower per Employee	Value added per Employee
Ratio of net imports to value of sales	.699* (t=4.147)	.695* (t=4.103)	.077 (t=.329)	.328 (t=1.472)
Ratio of imports to exports	.502* (t=2.460)	.593* (t=3.126)	.404† (t=1.872)	.311 (t=1.392)

B. Kendall's Coefficient of Concordance

	Skill Index-II	Skill Index-III	Horsepower per Employee	Value added per Employee
Ratio of net imports to value of sales	.726 (z=5.288)	.758 (z=5.385)	.347 (z=4.120)	.558 (z=4.769)
Ratio of imports to exports	.621 (z=4.964)	.642 (z=5.028)	.305 (z=3.990)	.494 (z=4.574)

Source: See Data Appendix (Appendix D).

Notes: (a) Each industry's skill index is computed relative to all manufacturing industries; sample of 20 industries used.

Skill Index-II--The percentage of employees in each industry who earned in excess of 9,000 CR per month.

Skill Index-III--The percentage of employees in each industry who earned in excess of 15,000 CR per month.

* Statistically significant at the one per cent level.

** Statistically significant at the two per cent level.

*** Statistically significant at the five per cent level.

† Statistically significant at the ten per cent level.

TABLE 4.5.--Rank correlation coefficients of imports and industry characteristics for 20 Brazilian industries, 1966.

	Industry Characteristics			
	Skill Index-II	Skill Index-III	Horsepower per Employee	Value added per Employee
Imports by industry as a percentage of total imports	.479*** (t=2.230)	.533** (t=2.669)	.458*** (t=2.186)	.395† (t=1.822)
Imports by industry as a ratio of industry's sales	.600* (t=3.180)	.653* (t=3.658)	.339 (t=1.528)	.417† (t=1.947)

Source: See Data Appendix (Appendix D).

Notes: See Table 4.4.

completely unskilled labor, Brazil "ought to" export goods that contain relatively large proportions of this abundant "factor." This includes a handful of agricultural commodities and especially coffee, cocoa, cotton and sugar. In part B of this chapter further details are spelled out.

B. Exports of Agricultural Commodities

In Chapter II, mention was made of the fact that as late as 1966-67 Brazil's exports of manufactures comprised only a small proportion of her total exports. Brazil's "revealed" comparative advantage rested with those commodities that were "nature" intensive, i.e., utilized a high proportion of natural resources and unskilled labor in their production. As I previously observed, a small number of such "nature" intensive commodities, specifically coffee, cocoa, cotton, tobacco and sugar, have dominated in the past and still dominate today Brazil's export structure.

Brazil has the climate and the soil suitable for the production of many important tropical crops. These conditions and the availability of cheap labor enabled Brazil to establish herself as the world's largest producer of coffee. Another natural resource that is plentiful in Brazil is forestry. According to FAO's <u>World Forest Inventory</u>, Brazil in 1958 had 12.7 per cent of the world's forests.[26] At the turn of the century Brazil accounted for over 80 per cent of the world's coffee production, though by 1958-59 her share fell to 50 per cent.[27] Sugar, cotton, tobacco, cocoa, oranges and rice are also produced and exported in substantial amounts.[28]

Only scattered information exists regarding the production methods and factor content of these agricultural commodities. An FAO study of coffee cultivation in Brazil enabled me to draw some inferences regarding factor intensities in its production. The study concentrates on Sao Paulo, the leading coffee producing state in Brazil.[29] The greater part of the State of Sao Paulo belongs to the tropical highland climatic zone where temperatures and the amount of rainfall are suitable for the cultivation of a wide range of agricultural products, including coffee.[30] For the most part the soil of the State of Sao Paulo is exceptionally fertile and suitable for coffee production.[31]

Labor is by far the most important variable factor used in the production of coffee.[32] The FAO survey indicates that on the average, 118 man-hours were needed to produce 100 kilograms of green coffee. About 90 per cent of the labor force was employed in operations related to harvesting coffee beans and weeding (weeding is done several times during a crop-year). Another five per cent was used in coffee processing, leaving only five per cent for non-routine operations that may involve more advanced cultivation techniques.[33] The labor used in the different phases of coffee production is almost entirely composed of unskilled workers. It was estimated that in 1958 the average hourly wage paid to workers on coffee farms in the State of Sao Paulo was eight cruzeiros.[34] The monthly average wage of about 1600 cruzeiros paid the coffee farm laborer should be compared to the federal <u>minimum</u> wage of about 6000 cruzeiros per month established in January, 1959.[35] Manufacturing establishments in the Sao Paulo area paid at least this minimum wage to their <u>unskilled</u> workers. Based on both the type of work performed and their earnings, the coffee farm-laborer must be considered largely devoid of any skill at all.

Fixed investment in land and coffee trees comprised about 80 per cent of the capital invested in coffee production. The FAO study discovered that less than 10 per cent of the total investment was in equipment and facilities used in the processing of coffee.[36] One of the main findings of the survey was the extremely low level of mechanization and capitalization characteristic of the various phases of coffee production and harvesting in Brazil. The FAO study concluded: "Coffee is bound to remain a labour-intensive [underlining mine] commodity to be produced only in areas where there is a relatively abundant labour supply that will accept relatively low wages."[37] Thus, it is appropriate to characterize Brazil's main commodity export, coffee, as being heavily dependent in its production on unskilled labor as well as natural--soil and climate--conditions.[38] No recent studies were available on the production of cocoa and cotton in Brazil, though it stands to reason that largely the same "natural" conditions were responsible for the low production costs and subsequent exports of these commodities.[39]

Conclusions to Chapters III and IV

Using "physical" capital labor ratio, the simple factor proportions theory did not fare well in explaining Brazil's trade patterns. The human capital or skill hypothesis, however, yielded good results in explaining Brazil's commodity composition of imports. As regards Brazil's exports, "nature" (i.e., natural conditions plus completely unskilled labor) was invoked to explain the country's comparative advantage in agricultural commodities. Unfortunately, because of the unavailability of systematic studies and data on the factor intensity of those commodities, the conclusions are somewhat tentative. The limited evidence presented in Chapter IV points to the combination of soil, climate and cheap labor as largely accounting for Brazil's export performance. The latest data available show that in the first half of 1969, coffee, cotton and cocoa still constituted 50 per cent of Brazil's exports.[40]

In 1969 Brazil exported about $250 million worth of manufactured goods or about 11 per cent of total exports.[41] This figure is impressive since at the beginning of the 1960's exports of manufactures were only about $25 million. Yet I maintain that these developments are not as encouraging as they appear because essentially they represent an extension of the post World War II growth based on import-substitution. In a perceptive speech to the 1964 UNCTAD conference, Raul Prebisch noted:

> Thus, a real vicious circle has been created as regards exports of manufactured goods. These exports encounter great difficulties because internal costs are high, and internal costs are high because, among other reasons, the exports which would enlarge the markets are lacking.[42]

In effect the exaggerated reliance on import substitution-induced growth may have spread the country's investments over a large number of small and inefficient manufacturing activities. The appearance of negative value added in empirical studies carried out in connection with the effective protection concept corroborated this point.[43] A negative value added measured at world prices signals the existence of domestic production resulting from the preponderance of high tariff protection and that would not exist if free trade would be permitted.

Exposing Brazil to a greater degree of foreign competition by reducing its excessive levels of protection may be the single most effective step toward a growth of the country's exports of manufactures. The longer run effect of this measure will be to expand Brazil's exports of manufactures along the line suggested by the principle of comparative advantage.

FOOTNOTES: CHAPTER IV

[1]Brazil has the climate and the soil that is suitable for the production of many important tropical crops. These natural conditions enabled Brazil to establish herself as the world's largest producer of coffee. At the turn of the century Brazil accounted for over 80 per cent of the world coffee production but has been falling since, in 1958-59 Brazil's share fell to 50 per cent. Sugar, cotton, tobacco, cocoa, oranges and rice are also produced in substantial amounts.

Another natural resource that is plentiful in Brazil is forestry. According to FAO's World Forest Inventory, Brazil in 1958 had 12.7 per cent of the world's forests. It must be added that most of these are in the sparsely populated Amazon basin and therefore present more of a future potential than actual reality. Brazil also has very large deposits of several important minerals. The country has almost one-quarter of the world's reserves of iron-ore, second only to the Soviet Union in that respect. Almost all of Brazil's iron-ore deposits are located in the state of Minas Gerais and most of it is high quality ore.

For details see: Dale, *op. cit.*

[2]Leontief, "Domestic Production . . .," *op. cit.*, also: Leontief, "Factor Proportions . . .," *op. cit.*, 386-407.

For the Japan-United States application see: M. Tatemoto and S. Ichimura, "Factor Proportions and Foreign Trade: the Case of Japan," *Review of Economics and Statistics*, XLI (November, 1959), 442-46.

For the United States-Indian case consult: R. Bharadwaj, "Factor Proportions and the Structure of Indo-U.S. Trade," *Indian Economics Journal*, X (October, 1962), 105-16.

[3]See: Hufbauer, *op. cit.*, Table 3, pp. 58-70.

[4]The theoretical basis and some evidence for the existence of factor intensity reversal internationally is contained in: B. S. Minhas, *An International Comparison of Factor Costs and Factor Use* (Amsterdam: North-Holland Publishing Co., 1963).

For a critical appraisal of this possibility in light of additional empirical evidence see: H. B. Lary, Imports of Manufactures From Less Developed Countries, National Bureau of Economic Research (New York: Columbia University Press, 1968), pp. 51-58.

[5]The United States data on value added, payroll and employment for 17 industries were obtained from: United States Bureau of the Census, Annual Survey of Manufactures 1959 and 1960 (Washington, D. C.: United States Government Printing Office, 1962).

For Brazil see Data Appendix (Appendix D).

[6]The rationale for the use of wage and salary components as a proxy for human capital and that of the non-wage value added as a proxy for physical capital used in industry, is contained in: Lary, op. cit., 20-22.

[7]Acknowledging the sensitivity of my result to the choice of weights, I performed the previous set of calculations, using as weights the ratio of the country's two-digit commodities to her manufactures exports and imports (SITC 5, 6, 7, and 8).

	Capital/man	Skill ratio	Wages/man
Imports	$15,999	.113	$6624.4
Exports	$14,868	.072	$6416.8

While the differences in capital per man and wages per man embodied in Brazil's exports and imports are very small, the large differentials in the skill content of Brazil imports and exports were still preserved. In no case did I get the "perverse" result that Brazil manufacturers exports could be characterized as containing more capital or skill, than her manufacturers imports.

[8]In 1964-67 some 84 per cent of Brazil's manufactures imports (SITC 5, 6, 7, and 8) originated in North America and Western Europe.

Calculated from Statistics in Data Appendix.

[9]Linnemann demonstrated that the volume of trade will be systematically related to the distance over which transportation takes place. The resistance to trade is directly related to the distance between the trading nations and includes elements such as transport cost, transport time and "psychic" distance, the latter refers to the relative familiarity with markets and customs of neighboring countries. These factors no doubt will effect trade among LAFTA members and especially among the two large neighboring countries, Brazil and Argentina. Among LAFTA countries Argentina is by far Brazil's most important trading partner. Both countries have relatively large industrial sectors and their commercial centers are

close. In addition both countries have instituted tariff reforms that were bound to effect their trade volume.

For detailed analysis see: H. Linnemann, An Econometric Study of International Trade Flows (Amsterdam: North-Holland Publishing Co., 1966), pp. 27-37.

TABLE 4.6.--Brazil's trade with Argentina and LAFTA countries, 1960-1965 (in million dollars).

	1960	1961	1962	1963	1964	1965
			Exports			
Argentina	56.4	67.4	48.4	46.2	90.8	140.9
LAFTA	86.4	95.2	75.7	76.0	132.7	197.4
			Imports			
Argentina	94.8	29.8	85.5	87.9	116.3	131.9
LAFTA	108.3	45.2	128.6	173.9	167.9	190.4

Source: Fundacao Getulio Vargas, "Foreign Trade-Brazil in the LAFTA," Conjuntura Economica (January, 1967), 17.

[10]The industrial countries proportion (Pi) of Brazil's total trade were calculated based on the following formula:

$$Pi = \frac{Ci + Ui + Wi}{Q}$$

Where: Ci = dollar shipments from Brazil to Canada of the i^{th} two-digit commodity.
Ui = dollar shipment from Brazil to United States of the i^{th} two-digit commodity.
Wu = dollar shipment from Brazil to Western Europe of the i^{th} commodity.
Q = Brazil's total imports (or exports) of manufactured goods in SITC categories 5, 6, 7, and 8.

Thus, Pi gives us the proportion of industrial countries' trade in manufactured goods with Brazil in each two-digit SITC category.

[11]This view was stressed in: A. D. Hirschman, "The Political Economy of Import-Substituting Industrialization in Latin America," Quarterly Journal of Economics, LXXXII (February, 1968), especially 13-17.

[12]Stanley J. Stein, The Brazilian Cotton Manufacture: Textile Enterprise in an Underdeveloped Area, 1850-1950 (Cambridge, Mass.: Harvard University Press, 1957), p. 180.

[13]Ibid., p. 182.

[14]Based on this approach a country exports only the "surplus" that is left over after the domestic market has been adequately supplied. The idea of concentrating output in specialized production for the export market is shunned.

These ideas are developed in: N. H. Leff, "Export Stagnation and Autarckic Development in Brazil, 1947-1962," Quarterly Journal of Economics, LXXXI (May, 1967), 286-301.

[15]The nominal and effective tariff rates levied on imports of three labor intensive commodities into the United States and the Common Market are reported by Balassa (see Table 4.7).

TABLE 4.7.--Nominal and effective tariff rates levied on selected imports.

	United States		Common Market	
	Nominal	Effective	Nominal	Effective
Textile fabrics	24.1	50.6	17.6	44.4
Wood products	12.8	26.4	15.1	28.6
Leather	9.6	25.7	7.3	18.3

Source: B. Balassa, "Tariff Protection in Industrial Countries: An Evaluation," Journal of Political Economy, LXXIII (December, 1965), 573-97, Table 1.

[16]For detailed explanation and economic rationale for these measures see: Lary, op. cit., pp. 20-35.

[17]Kenen, op. cit., 437-42.

[18]Among the most notable contributions in this area are: Theodore W. Schultz, "Reflections on Investment in Man," Journal of Political Economy, LXX, Supplement (October, 1962), 1-8, and Becker, Human Capital: . . ., op. cit.

For a more recent contribution see: Stanley M. Besen, "Education and Productivity in U. S. Manufacturing:

Some Cross-Section Evidence," Journal of Political Economy, LXXVI (May/June, 1968), 494-97.

[19]For a rigorous presentation see: Gary Becker, Investment in Human Capital: A Theoretical Analysis," Journal of Political Economy, LXX, Part 2 (October, 1962), 9-49.

[20]Helen Waehrer, "Inter-industry Skill Differences, Labor Earnings and U. S. Foreign Trade, 1960" (unpublished Ph. D. dissertation, Columbia University, 1966).

[21]The six occupational classes are: I--Professional, technical and kindred workers; II--Managers, officials and proprietors; III--Clerical and kindred workers; IV--Sales workers; V--Craftsmen, foremen and kindred workers; VI--Service workers.

For details see: Waehrer, "Inter-industry . . .," op. cit., pp. 92-97, Table 3.3.

[22]Contained in: IBGE, "Servico Nacional de Recenseamento," Censo Industrial de 1960, Brazil, p. 62.

[23]Ibid., p. 63.

[24]The skill indexes of each industry are then divided by the percentage of employees classified as skilled in all transformation industries. Therefore in effect we obtain a relative skill quotient of each major industry group.

[25]For the difference between these two non-parametric test see: S. Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill, 1956), pp. 229-39,

[26]From: Dale, op. cit., pp. 1-3, and Survey of the Brazilian Economy 1966 (Washington, D. C.: Brazilian Embassy, 1967).

[27]For an interesting and detailed discussion of the role of coffee in Brazil's economic history (especially in the State of Sao Paulo) see: William H. Nicholls, "The Transformations of Agriculture in a Semi-Industrialized Country: The Case of Brazil" (presented to the Conference on the Role of Agriculture in Economic Development, sponsored by the NBER, New York, December 1-2, 1967), especially pp. 15-31.

[28]See Table 4.8, p. 76.

TABLE 4.8.--Brazil's exports of agricultural commodities, 1952-54 and 1962-64 annual averages (in millions of dollars).

SITC No.	Commodity	1952-54	1962-64	Exports of each commodity as of total exports 1962-64.
061	Sugar	13.30	48.51	.030
071	Coffee	1024.95	716.88	.530
072	Cocoa	94.50	45.88	.030
24	Wood	38.68	45.11	.030
121	Tobacco	17.84	25.53	.020
262	Wool	9.27	9.11	.007
263	Cotton	123.5	114.67	.085
	All Exports	1503.3	1350.0	.732*

Notes: * = Proportion of all commodity exports listed in the table as of total exports, 1962-64.

Source: Statistical Office of the United Nations, Yearbook of International Trade Statistics (New York: United Nations, various years).

[29]Economic Commission for Latin America and the Food and Agricultural Organization of the United Nations, Coffee in Latin America, Vol. II: Brazil, State of Sao Paulo (Mexico: United Nations, 1960), pp. 1-111.

[30]Other commodities grown in the different regions of the State are: sugar cane (the Southern region), cotton (the Western region), also maize, rice and beans are grown in smaller quantities.
Taken from: Ibid., pp. 14-18.

[31]One of the main differences between coffee production in Brazil (chiefly in the State of Sao Paulo) and that in the so-called "mild coffee" producing countries such as Columbia, is the absence of shading of coffee plants in Brazil. In Sao Paulo the coffee plantings are grown in the open field, exposed to direct sunlight. This practice together with the topography of the coffee

zones of Sao Paulo is responsible for the typical production practices, which are generally simpler and more labor intensive than those used in Columbia and Central America.

For details see: ECLA and FAO, Vol. II, op. cit., Part I, Chapter III, p. 39.

[32]This is also true of coffee production in the so-called "mild coffee" producing areas of Latin America (e.g., Columbia). A FAO study of coffee growing in Columbia noted ". . . Columbian coffee--with specific exceptions--is almost exclusively the product of the land and labor factors." Of the total cost involved in coffee production, between 75 and 90 per cent is represented by the work of the farmer and his family or by day labor.

ECLA and FAO, Coffee in Latin America, Vol. I: Columbia and El Salvador (New York: United Nations, 1958), especially Chapter V, pp. 42-43.

For a more thorough discussion of overall productivity trends and wages in Brazilian agriculture consult: William H. Nicholls and R. M. Paiva, "Structures and Productivity of Brazilian Agriculture," Vanderbilt University and Funcacão Getulio Vargas, undated. (Mimeographed.)

[33]Weeding is typically done by hand with the aid of hoes. The picking operation involves thrashing the coffee trees with sticks, and then picking and separating the fallen coffee berries from other materials. Non-routine operations include replanting, fertilization and soil management practices.

ECLA and FAO, Vol. II, op. cit., Chapter LV, Table 15, pp. 36-40.

[34]Ibid., Part I, Chapter V, p. 48.

[35]W. Baer, Industrialization and Economic Development in Brazil (Homewood, Ill: Richard D. Irwin, 1965), Table 3A-13 (A), p. 251.

[36]See Table 4.9, p. 78.

[37]ECLA and FAO, Vol. II, op. cit., Part I, p. 41.

[38]One of the more interesting findings of the coffee survey was that regardless of their size, all coffee farms seem to use essentially the same (labor intensive) production technique. Furthermore, as can be seen from Table 4.10 (see page 78) coffee growing can be classified as labor intensive relative to other agricultural commodities, that were grown on these farms.

TABLE 4.9.--Total capital investment on coffee farms, 1958 (per cent distribution).

Type of Investment	Per cent per thousand producing trees	Per cent per hectare
Coffee land	26.3	26.1
Producing trees	51.6	51.3
Housing units	10.5	10.9
Storehouses, other buildings	2.0	1.9
Work animals, equipment, vehicles for animals	1.1	1.1
Mechanical power vehicles and equipment	3.8	3.8
Electrical power plants, water pumps, and tools	.4	.7
Buildings and equipment for coffee processing	4.2	4.2
Total	100.0	100.0

Source: ECLA and FAO, Coffee in Latin America, Vol. II: Brazil, State of Sao Paulo (Mexico: United Nations, 1960), Part I, p. 63, Table 50.

TABLE 4.10.--Labor input required in growing of coffee and other crops (man-days per hectare).

Crop	Crop	Man-days per hectare
	Maize	20.9
	Rice	39.8
	Castor bean	32.8
	Sugar cane	65.6
	Coffee	73.4

Source: ECLA and FAO, Coffee in Latin America, Vol. II: Brazil, State of Sao Paulo (Mexico: United Nations, 1960), Part II, especially Tables 16, 22, 23, 24, and 25, pp. 38-48.

[39] In Brazil the production of cocoa is concentrated in the State of Bahia. As in the case of coffee, specific climatic conditions (those prevailing in the tropical lowlands) and soil conditions are required for cocoa farming. Again the various activities involved in the cultivation of the cocoa trees, such as clearing, shading, pruning, and harvesting, require large proportions of unskilled (low wage) labor.

For details see: V. D. Wielcizer, Coffee, Tea and Cocoa (Stanford, Calif.: Stanford University Press, 1951), especially Chapter 13, pp. 282-92.

Information as regards cotton production in Brazil was found in: Frank D. Barlow, Jr., Cotton in South America: Production, Marketing, Consumption, and Developments in the Textile Industry (Memphis, Tenn.: National Cotton Council of America, 1952), Chapter II.

[40] International Monetary Fund, International Financial Statistics, XXIII (February, 1970), 58-59.

[41] Michael Sieniawski, "Favorable Trade Balance Boosts Brazil's Outlook," The Christian Science Monitor, Feb. 26, 1970.

[42] United Nations, Proceedings of the United Nations Conference on Trade and Development, Vol. II, Policy Statement (New York: United Nations, 1964), p. 14.

[43] For a full discussion of this concept see: S. E. Guisinger, "Negative Value Added and the Theory of Effective Protection," Quarterly Journal of Economics, LXXXIII (August, 1969), 415-33.

CHAPTER V

THE EFFECTS OF PROTECTION ON INCOME DISTRIBUTION: THEORETICAL ISSUES

A. The "Classical" Doctrine and Income Distribution

The theory of comparative cost has been associated with the work of the classical economists, primarily David Ricardo and John Stuart Mill.[1] It was further elaborated upon by Marshall, Edgeworth and Mangoldt among others.[2] The principle of comparative advantage stresses the gains from free international trade, as a result of letting each country specialize in the production of a commodity it makes relatively more cheaply, or at a lower opportunity cost. Given a fixed amount of productive resources, and a free exchange of goods, the principle of comparative advantage demonstrates that it is possible for each participant in a voluntary exchange to consume more of at least one commodity, while consuming no less of the other, i.e., increase its real income.

The discussion of the effect of trade on income distribution was taken up initially in connection with the existence of non-competing groups or "specific" factors of production.[3] The neoclassical economists generally recognized that the opening of free trade would affect the prices of certain factors--such as a non-competing group of workers. Haberler described the effect of free trade on the distribution of income in the following manner: Free trade will cause a rise in the relative wages received by workers specific to the export industry, and a fall in the wages of those workers who are specific to the import-competing industry.[4] Thus, it was argued that a "specific" factor or a non-competing labor group would be harmed from the reduction or elimination of a tariff on a product that required this factor in its production. Haberler viewed the problem of the "specific" groups of workers essentially as a short-run phenomenon, asserting that over the long run labor was the most easily adaptable of all factors.[5]

This discussion took on an empirical turn with the so-called Australian Tariff Controversy.[6] The specific question at issue was whether a tariff would lead to an improvement in the standard of living of Australian labor, labor being presumably Australia's scarce factor and land its abundant factor. Several of the participants in the debate concluded that while a tariff would reduce national income, it would raise the real renumeration of Australia's scarce factor--labor.[7]

B. Inquiry into the Effects of a Tariff on the Distribution of Domestic Income

Currently the most widely accepted and most thoroughly discussed explanation of the patterns of international trade is the so-called "factor endowment" theory. The Heckscher-Ohlin model attempts to explain commodity trade flows in terms of the relative scarcity or abundance of different factors used in the production of traded commodities.[8]

Based on this model differences in relative prices (costs) of commodities between two countries will arise when two conditions are met: (1) the countries' relative factor endowments (and relative factor prices) differ; and (2) the relative factor intensities used in the production of the various commodities differ. In each country the commodities that contain a high proportion of the relatively abundant or cheap factor will tend to be exported in exchange for imports that require a high proportion of the country's relatively scarce factor.[9] Free trade and the resulting growth of the country's exports requiring a high proportion of the relatively cheap factor in their production will lead to an increase in the demand for that factor, thereby tending to raise its price. Similarly, the contraction of the import-competing goods industries, that require a high proportion of the dear factor, will tend to reduce the price of that factor.

Based on the assumptions embodied in the factor endowment model, Stolper and Samuelson analyzed the effects of trade on the distribution of income for a single country.[10] By choosing a set of assumptions that eliminated the index number problem, they demonstrated that a tariff will raise the money and real wage of the country's "scarce" factor while lowering the money and real wage of its "abundant" factor.

As a result of the imposition of the tariff, the domestic price of the import-competing good will rise relative to the exportable good. This will shift resources from the production of exportables to the production of import-competing goods. Since the two industries use factors (e.g., labor and land) in different proportions, the shift will raise demand for the scarce factor (labor) that is being used relatively intensively in the import-competing industry and lower demand for the abundant factor (land) used intensively in the production of the exportable.

The contracting industry (producing exportables) will release much land and little labor, compared to the proportion that these factors can be absorbed in the import-competing industry. This will lead to relative scarcity of labor, thereby raising the marginal product of labor. Correspondingly, under competitive market conditions the real (as well as money) wage of labor wil rise relative to the rent on land.

At constant terms of trade a tariff will raise the price of the importable good in the tariff-imposing country by the full amount of the tax. This autonomous increase in the price of the importable commodity will result in an increase in the renumeration of the factor used relatively intensively in its production.

Let me demonstrate the argument graphically. At the outset assume perfectly competitive conditions to exist. Each industry employs either skilled or unskilled labor in a fixed combination with "physical" capital to produce the final product. Suppose commodity units are so chosen that at the initial equilibrium the relative prices of the two goods produced (A and B) are equal. Under these conditions the production of commodity A would be skilled labor-intensive and that of commodity B would be "physical" capital-intensive (see points a and b in Figure 5.1. As a result of the tariff levied on commodity A, the price of this skilled labor-intensive good has increased. Thus, in the new equilibrium factor renumeration must be such that the average cost of producing commodity A will be higher than the average cost of producing good B. In terms of Figure 5.1, the "new" isocost (C_1C_1 or C_2C_2) must be flatter than the original isocost (C_0C_0). This then assures that the cost of producing a unit of A has risen relative to the average cost of producing a unit of B. In both industries the ratio

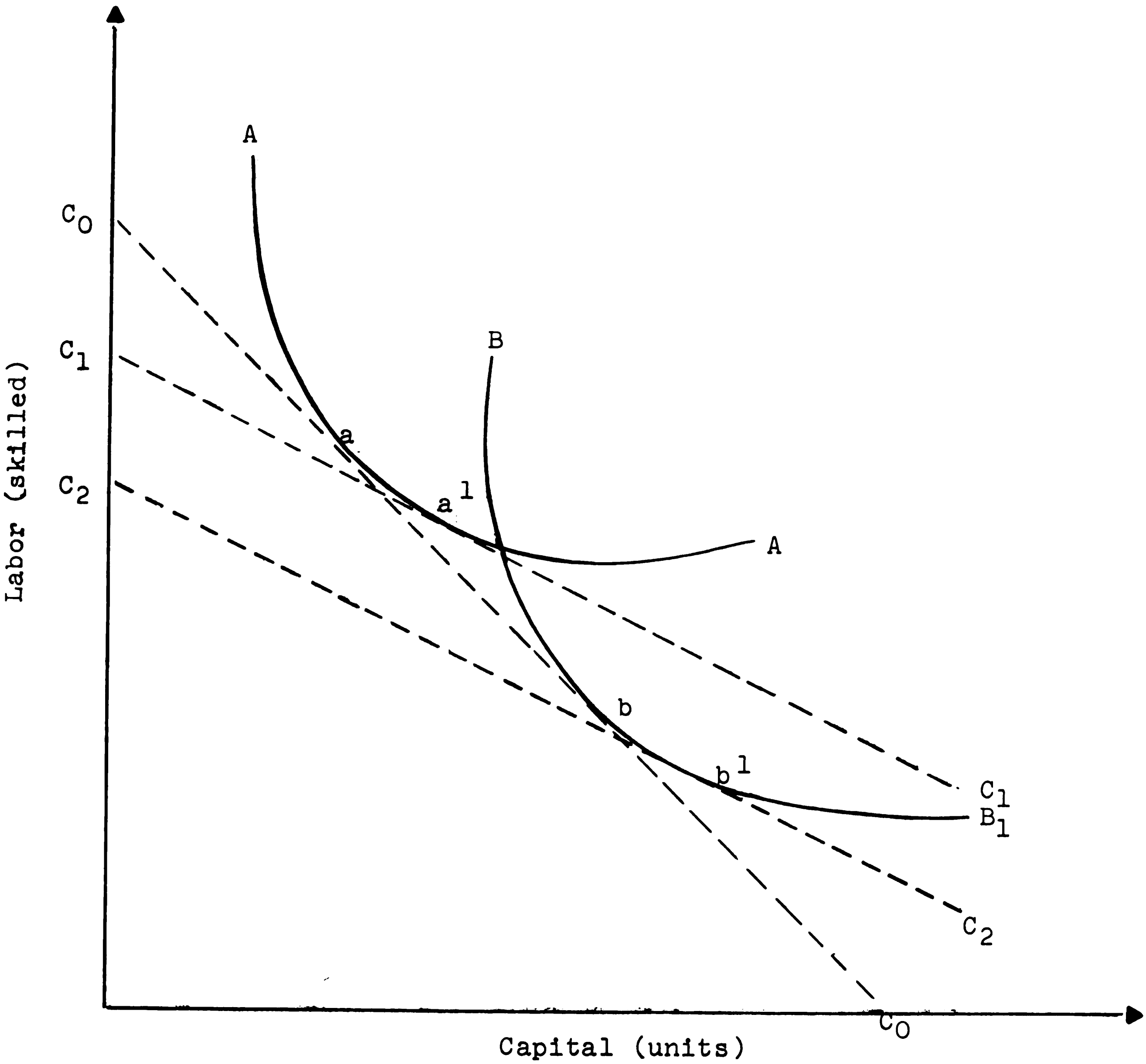

Figure 5.1

of capital to skilled labor has increased (compare points: a and a^1; and b and b^1). Given the assumption of diminishing returns, the marginal product of skilled labor and thereby its wage have to rise relative to the rent on capital.

If the price of the <u>unskilled</u> labor-intensive commodity (commodity C) has not changed relative to the physical capital intensive good (B) then the wage of skilled workers has risen relative to the wage of unskilled labor, as well as against the rent on "physical" capital. Thus, if a tariff is levied to protect the country's scarce factor (e.g., skilled labor) it will have to raise the price of the commodity using the scarce factor relatively intensively, otherwise it will have an adverse protective effect. Note that the same argument can be appropriately applied on two non-competing groups of labor (such as "skilled" and "unskilled" labor) instead of labor and capital. In this instance, the imposition of a tariff will raise the wages received by the "skilled" workers (the tariff imposing country's scarce factor), the factor used relatively intensively in the production of the import-competing good.

This analysis, however, does not consider how the imposition of a tariff changes the country's terms of trade. As Metzler pointed out, the external terms of trade of the tariff-imposing country will generally improve, the single exception being when the country faces an infinitely elastic foreign offer curve.[11] On the other hand, when the foreign offer curve is inelastic, the country's terms of trade may improve by more than the amount of the tariff. However, the crucial consideration regarding the Stolper-Samuelson theorem is what happens to the domestic price of importables in relation to the price of exportables when a tariff is levied. Therefore, even when the foreign offer curve is inelastic, the relevant question is whether the terms of trade of the tariff-imposing country will improve sufficiently so that the tariff inclusive price of importables will be lowered.

As an illustration of the so-called "Metzler case" consider the following conditions (see Figure 5.2). Brazil exports coffee and imports "machinery" from its chief trading partner, the United States. Assume that the foreign offer curve is highly inelastic in the "neighborhood" of the pre-tariff equilibrium, point E. Assume that an ad-valorem tariff equal to HG^1/OH in terms of the exportable commodity, coffee, is levied by the Brazilian government. In the pre-tariff situation the world price and domestic price are both equal to the ratio GE/GO. With the tariff the world price (the terms of trade) and the domestic price diverge. The new external terms of trade are so much more favorable to Brazil (HE^1/HO) that the tariff-inclusive domestic price

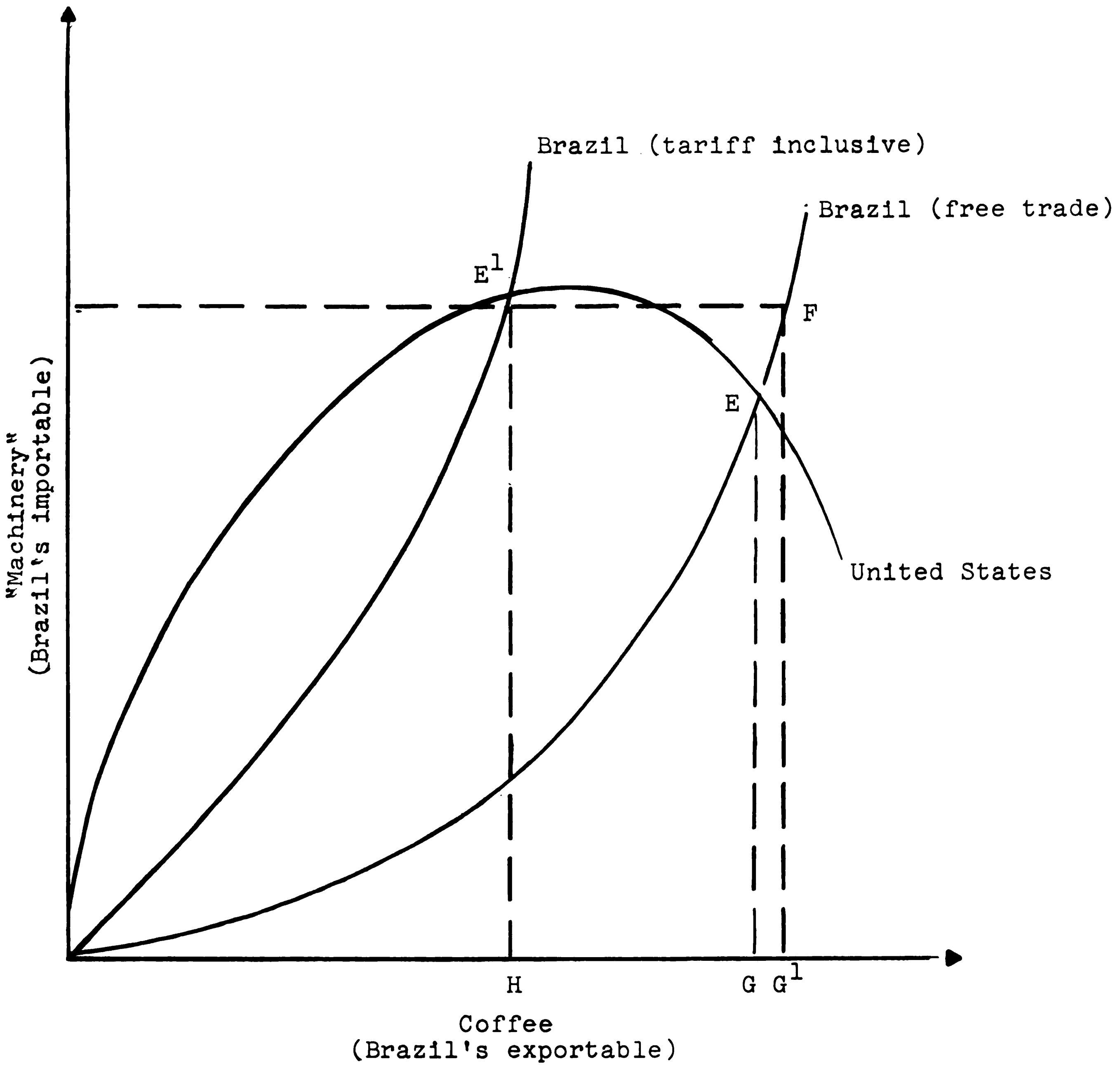
Brazil (tariff inclusive)
Brazil (free trade)
E^1
F
E
United States
"Machinery" (Brazil's importable)
H
G
G^1
Coffee (Brazil's exportable)

Figure 5.2

of "machinery" in terms of coffee is lower in comparison to the pre-tariff situation. Compare G^1F/G^1O, the tariff-inclusive domestic price, to GE/GO, the pre-tariff domestic and external terms of trade.

Thus the imposition of a tariff under these conditions will reduce the domestic price of "machinery" relative to the price of coffee. Assuming that the protected industry requires large amounts of the scarce factor in its production (e.g., skilled labor), this factor will be injured as a result of the tariff levied to "protect" it. Therefore, when the demand for the country's exports is highly inelastic, the scarce factor of production may suffer both a relative and an absolute reduction in its renumeration as a result of the tariff.

It is of interest to note that Metzler was aware of the relevancy of his theoretical expose to the practical problems of development facing Latin America. Metzler stated the possibility of applying his results to Latin America quite explicitly:

> If the demand for Latin America's exports as a whole is acually inelastic--and there is little reason to doubt this--the preceding discussion suggests strongly that tariffs may accomplish little either in protecting Latin American manufacturing or in increasing the share of workers in national income.[12]

The favorable movement in the terms of trade may more than offset the immediate effect of the tariff, which would be to raise the price of the products of the protected manufacturing industry.

Our study does not deal with Latin America as a whole, but is confined to a case analysis of Brazil. (The investigation of the elasticities of Brazil's commodity trade is the subject of Appendix A.) Based on a cursory examination of the composition of Brazil's main commodity exports, the "Metzler case" appears plausible at the outset. As was noted in Chapter III, Brazil's main exports have been limited to a small number of primary commodities. Traditionally coffee, cocoa, cotton and sugar constituted the great bulk of Brazil's exports. It is generally accepted that the world demand for these agricultural exports is inelastic.[13]

Yeager pointed out that there is a greater likelihood of a country facing an inelastic demand for its exports if its exports consist of a few commodities for which world demand is highly inelastic and if, in addition, it does not face "considerable" competition in world markets.[14] Brazil has traditionally supplied a significant proportion of world trade in coffee and cocoa, in recent years about 40 per cent and 15 per cent of world exports of the two commodities respectively (for details consult Appendix A). Brazil supplied a very small proprotion of world trade in the "minor" agricultural exports, i.e., cotton, sugar and tobacco. Thus, even if <u>world</u> demand for the "minor" agricultural exports is highly inelastic (and the evidence presented in Appendix A suggests that it is) the demand for Brazil's exports of those commodities is most likely elastic. Based on these rather general considerations, it is reasonable to assume that the price elasticity of demand for Brazil's primary commodity exports is just above one. Yet as will be argued in section C of this chapter, even if the world demand for Brazil's exports as a whole is inelastic, it would only be a necessary but not sufficient condition for the "Metzler Case" to exist.

C. Further Issues Related to the Effect of Tariff on the Distribution of Income

Until now the manner in which the tariff proceeds are disposed was ignored. The implied assumption in the classical treatment was that the tariff proceeds are either destroyed or spent on home goods alone. One way of dealing with this problem would be to assume that the government spends the tariff revenue on some combination of exportables and importables, based on its preference function. Alternatively, one could assume that these receipts are passed on to the consumers in the form of a general income subsidy (or reduction in their income tax payments). If we accept the second assumption (thus dispensing with the necessity of formulating a government demand function), the necessary condition for a tariff to raise the domestic price of the importable is that the foreign demand elasticity for imports (i.e., Brazil's exports) plus the domestic marginal propensity to import is greater than one.[15] Thus the existence of the "Metzler case" is less likely as long as the importable good is not an inferior good, even if the demand for the tariff-imposing country's exports is inelastic.

Lancaster also took issue with the universality of the Stolper-Samuelson theorem.[16] He noted that if one is given only the production functions, the factor endowments and the terms of trade but not the consumption patterns of the wage earners and the capital owners, it is impossible to determine a tariff's effect on a factor's renumeration. Take for example a country that is relatively labor abundant; and clothing (the labor intensive good) is the wage good. It is conceivable that consumers (both labor and owners of capital) prefer clothing in their consumption to such an extent that clothing becomes relatively dear and it will be imported. This is similar to the notion that under certain circumstances differences in taste can outweigh comparative cost in determining countries' trade patterns. Thus the country ends up importing the commodity that is intensive in its relatively plentiful factor (labor). A tariff imposed under such circumstances would raise the real wage of the factor used intensively in the imported good (labor), but in this case it turns out not to be the "scarce" factor.

Lancaster next offers a "general" reformulation of the Stolper-Samuelson theorem, noting that what is necessary in order to determine the effect of protection on real wage is the knowledge of the factor intensity of the imported good and not the relative factor endowments of the country.[17] According to Lancaster: "The true general theorem of protection and real wages is, therefore, that: Protection will raise the real wage of labour if, and only if, the country imports the labour intensive good."[18]

Bhagwati and Johnson expanded this analysis by abandoning the previous assumptions that the initial state of equilibrium is one of free trade and that private demand is independent of government expenditure (or government consumption).[19] The last part of their paper analyzes the effect of a tariff on the domestic price of importables and on the distribution of income between factors of production.[20] Considering the "Metzler case" Bhagwati and Johnson concluded that if the domestic price of importables is to fall as a result of a tariff, the foreign demand elasticity for the tariff imposing country's exports must be smaller than the government's marginal propensity to spend on exportables. However, if initially a tariff was in existence the aforementioned condition is a necessary but not a sufficient condition for the fall in the domestic price of importables. In effect, the absence of free trade initially makes the occurrence of the "Metzler case" less likely.[21]

Next, Bhagwati and Johnson assumed that the private traders' demand for importables is dependent on the level of government expenditure (consumption).[22] Dependence implies that the amount of services provided by the government enters the private individual's utility function in a significant way. Therefore, the private sector's demands for goods and services becomes a function of the government's expenditures of consumption. It is clear that the effect of a tariff on the new equilibrium of an economy will vary with the nature of the dependence between private demands and government consumption. To borrow an example from Bhagwati and Johnson, should the government increase expenditure on law enforcement services one would expect a fall in private expenditure on fire-arms, locks and bodyguards. Presumably, the relationship noted above is one of substitution between private and public expenditure.

If, on the other hand, the relationship is one of complementarity, then an increase in government expenditure will have the indirect effect of increasing private demand for goods and services (among them importables). For example, increased government expenditure on highway construction would lead to increased private consumption of goods and services related to transportation. In this case it is <u>less</u> likely that a tariff will reduce the domestic price of the importable, even though the foreign demand for the country's exports may be inelastic.[23]

To summarize the discussion so far, I noted that Metzler challenged the part of the Stolper-Samuelson theorem which stated that a tariff will <u>always</u> increase the domestic price of the commodity that employs the "scarce" factor relatively intensively (i.e., the importable). The necessary conditions for the "Metzler case" to occur were that the demand for the tariff imposing country's exports be inelastic; and that the country's marginal propensity to consume its exportables be larger than the foreign demand elasticity for its exports. Metzler concluded that under these conditions the tariff will cause an improvement in the country's terms of trade that will be larger than the size of the tariff and consequently cause a fall in the relative domestic price of the importable commodity (including the tariff). Baldwin and Bhagwati and Johnson were essentially in accord with Metzler's original results; however, they proceeded to relax and change certain of his assumptions, with the purpose of "generalizing" and as it turned out, qualifying the "Metzler case."[24]

I shall consider next how the structure of Brazilian protection relates to the relative scarcity of the country's factors of production (established in Chapters III and IV). I wish to determine on a priori grounds which factor is likely to benefit from changes in the level of protection. These findings will then be integrated into, and the hypothesis tested in, a wage determination model that will attempt to discern the effect of protection on the earnings of industrial labor.

FOOTNOTES: CHAPTER V

[1]David Ricardo, The Principles of Political Economy and Taxation, Everyman's Library Edition (New York: E. P. Dutton and Co., 1911), also J. S. Mill, Essays on Some Unsettled Questions in Political Economy, reprint (London: London School of Economics and Political Science, University of London, 1948).

[2]For a thorough discussion of the comparative cost doctrine consult: Jacob Viner, Studies in the Theory of International Trade (New York: Harper and Bros., 1937).

[3]J. E. Cairnes, Some Leading Principles of Political Economy Newly Expounded (New York: Harper and Bros., 1874), Chapter III, also F. W. Taussig, International Trade (New York: MacMillan Co., 1927), pp. 43-60.

[4]For details see: Gottfried Haberler, Theory of International Trade: With Its Application to Commercial Policy (London: W. Hodge and Co., 1936), pp. 189-90.

[5]Ibid., p. 195.

[6]For a summary of the controversy see: Jacob Viner, "The Australian Tariff," Economic Record, V (November, 1929), 306-15.

[7]See for example: W. B. Reddaway, "Some Effects of the Australian Tariff," Economic Record, XIII (June,, 1937), 22-30.

[8]For details consult: Caves, op. cit., pp. 24-30 and 76-92, also Ford, op. cit.

[9]Minhas raised the possibility that factor-intensity reversal may make predictions regarding the composition and direction of trade, invalid. More recently several writers have taken to a skeptical view of Minhas' empirical results on the actual importance of the factor-reversal phenomenon.

For restatement of Minhas' results and the objections raised thereof, see: Lary, op. cit., pp. 51-58.

[10]Stolper and Samuelson, op. cit., 58-73.

[11] Metzler, *op. cit.*, 1-29.

[12] *Ibid.*, 24.

[13] For detailed analysis of Brazil's export trade see Appendix A.

[14] It is important to note that even if world price elasticity of demand for coffee is highly inelastic, the demand for Brazil's coffee may be *elastic*. As an illustration consider the following:

$$(1) \quad \eta_{\text{coffee}}^{\text{Brazil}} = \frac{1}{B}\,\eta_{\text{coffee}}^{\text{world}} + \frac{C}{B}\,e_{\text{coffee}}$$

Where: $\eta_{\text{coffee}}^{\text{world}}$ = price elasticity of world demand for coffee (a "reasonable" estimate--(-.25)).

B = Brazil's share of world exports of coffee (about 50 per cent in the early 1950's).

C = competitors share of world exports of coffee.

e_{coffee} = competitors supply elasticity of coffee.

From equation (1) and the assumed values of the parameters note that: so long as the elasticity of supply of Brazil's competitors is smaller than 1/2, the demand for Brazil's coffee exports will be inelastic (<1).

For the derivation of formulat (1) see: L. B. Yeager, *International Monetary Relations: Theory, History and Policy* (New York: Harper and Row Publishers, 1966), p. 140.

The parameter values were taken from: Baer, *op. cit.*, pp. 39-43, Table 3-4.

[15] The change in the domestic price of an importable as a result of the tariff imposition is given by:

$$(2) \quad \frac{d[P(1+\Pi]}{d[1+\Pi]} = \frac{\eta_B+m_A-1}{\eta_A+\eta_B-1}$$

Where: η_B = foreign elasticity of demand for imports.

η_A = the tariff imposing country's elasticity of demand for imports.

m_A = the marginal propensity to spend on imports in the tariff imposing country.

P = the terms of trade (price of importables in terms of the tariff imposing country's exports).
Π = ad valorem tariff.

Thus the Stolper-Samuelson result will be obtained as long as:

$$(\eta_B+m_A-1)$$

and the domestic elasticity of demand for importables (η_A)

is less than infinite. Also it is clear from formula (2) that if the importable is an inferior good

$$(\text{i.e., } m_A<0)$$

a tariff may decrease the domestic price of importables even if the foreign offer curve is elastic.

For the mathematical development of formula (2) see: R. A. Mundell, International Economics (New York: The MacMillan Co., 1968), pp. 26-31, especially footnote 11.

For a geometric exposition see: Robert E. Baldwin, "The Effect of Tariffs on International and Domestic Prices," Quarterly Journal of Economics, LXXIV (February, 1960), 73-78.

[16]Kelvin Lancaster, "Protection and Real Wages: A Restatement," Economic Journal, LXVII (June, 1957), 199-210.

[17]Ibid., 207-09.

[18]Ibid., 209.

[19]J. Bhagwati and H. G. Johnson, "A Generalized Theory of the Effects of Tariffs on the Terms of Trade," Oxford Economic Papers, XIII (October, 1961), 225-53.

[20]Ibid., 246-53.

[21]The necessary condition being that the foreign demand for exports be inelastic, the sufficient condition derived by Bhagwati and Johnson for the case when a tariff is initially in existence is that:

$$(3) \quad \eta_B<(1-g) - \frac{M_g}{M}\eta_g$$

Where: η_B = the foreign demand elasticity for the tariff imposing country's exports.
g = the government's marginal propensity to spend tariff revenue on imports

$(1-g)$ = the government's marginal propensity to spend tariff revenue on exports.

$\frac{M_g}{M}$ = the quantity of importables consumed by the government out of tariff proceeds as a ratio of total imports.

η_g = the compensated elasticity of government demand for importables.

For details consult: Bhagwati and Johnson, op. cit., 250.

[22]Other writers such as Metzler and Baldwin treated government consumption as being essentially equivalent to private consumption of either importables or exportables.

[23]In this case the result is evident on the basis of informal reasoning. In the case of complementarity between private and public consumption, a positive excess demand for importables (that will raise their domestic prices) is more likely to occur; since to any government demand for importables we would have to add the private sector's demand for the importables.

For formal derivation see: Bhagwati and Johnson, op. cit., 251.

[24]For the most recent controversy regarding the "Metzler Case" see: B. Södersten and K. Vind, "Tariffs and Trade in General Equilibrium," American Economic Review, LVIII (June, 1968), 394-408.

The restatement of the "orthodox" results is found in: R. W. Jones, "Tariffs and Trade in General Equilibrium: Comment," American Economic Review, LVIX (June, 1969), 418-24.

CHAPTER VI

THE STRUCTURE OF BRAZILIAN PROTECTION

A. Recent History

Brazil's position as an important world supplier of various agricultural commodities enabled her to accumulate large foreign exchange reserves during World War II. After the war, given the satisfactory level of its reserves, the government adopted a liberal import policy. An overvalued exchange rate established at the pre-1930 parity led promptly to a disequilibrium in the country's Balance of Payments.[1] Subsequently, the government chose a system of import licensing and exchange control to deal with the external disequilibrium. The Bank of Brazil, that administered the licensing system, established a scale of priorities based on the "essentiality" of various imports.[2] The large differential between the official exchange rate and the free market value of foreign exchange led to allocative inefficiencies as well as widespread bribery and dishonesty. As a result of these abuses and deficiencies, there was considerable opposition to the continued application of quantitative controls.

In 1954 Brazil's external situation took a turn for the worse. A fall in world coffee prices without a significant increase in the volume of Brazil's coffee exports caused its capacity to import to decline. On October, 1953 an important reform was undertaken in Brazil's exchange system. The system of direct licensing was abolished and replaced by a system of multiple exchange rates.[3] Imports were classified into five different categories, based on the government's view of their essentiality. In the least favorable group were luxury items, together with those goods for which the local supply was satisfactory.

In each category exchange certificates, representing the exchange available, were sold in separate auctions by the authorities. The operation of market forces simplified the complex system of multiple exchange rates. The administrative discretion was limited to the allocation of commodity imports into the different categories. Within each category competitive bidding of importers in separate foreign exchange auctions determined the actual composition of imports.[4] The actual import rate thus became the par value of the currency plus the variable auction rate and any additional taxes levied. Exempted from the auction were imports considered essential, e.g., petroleum, wheat, printing paper and certain types of equipment for industry.

Another feature of the system was an adjustable multiple export rate distinguishing between major categories of exports. Exports of manufactures were included in the most favored category, while exports of coffee, raw cotton, cocoa and certain other agricultural exports were placed in the less favored category.[5] Restrictions on capital transfers and remittances of profits were abolished. A free market exchange rate was allowed for these types of transactions along with services.

Over the years the exchange system underwent certain changes. Imports were reclassified among the five categories; and the minimum bids were raised over time to keep up with inflation. On the export side, the changes resulted in finally setting up four export categories in the beginning of 1955 (see Table 6.1).

The system of multiple exchange rates and exchange auctions seems to have been an improvement over the previous licensing arrangement. In the first place, arbitrary criteria of allocation were to some extent replaced by impartial market forces. Yet the government retained the important privilege of setting the minimum bid rates and reclassifying goods among categories. Secondly, the large profits reaped previously by those fortunate to obtain licenses were now channeled to the government. On the negative side, the wide and frequent fluctuations of the auction premiums and as a consequence, of the effective

TABLE 6.1.--Exchange rates (cruzeiro per United States dollar), January 1, 1956.

Selling rate		Buying rate	
Official rate	18.82	Official rate	18.36
Some gov. imports, including wheat	43.82	Category II exports	35.55--37.06
Petroleum products	33.82--168.82	Category III exports	41.31--43.06
Fluctuating free market rate*	67.50	Category IV exports	48.03-50.06
Category I imports	86.70--88.80	Fluctuating free market rate*	66.00
Category II imports	97.20--99.80		
Category III imports	173.70--173.80		
Category IV imports	237.00		
Category V imports	344.80		

Source: Adapted from IMF, Seventh Annual Report on Exchange Restrictions 1956 (Washington, D. C.), pp. 53-54.

Notes: Following--the main items included in each export and import category.

Exports: Category II--Coffee and bananas.
Category III--Raw cotton, cocoa beans, cocoa paste, pinewood, tobacco, raw hides, skins, etc.
Category IV--All other exports.

Imports: Category I--Agricultural supplies, certain pharmaceuticals, etc.
Category II--Ores, scrap metals, other essential raw materials.
Category III--Wood, industrial machinery and equipment, spare parts, vehicles.
Category IV--Office machinery, less essential spare parts and equipment, fresh fruits, certain consumer goods.
Category V--All other imports.

* Exchange proceeds from most invisibles were sold through the free market. The inflow and outflow of foreign investment was also effected through the free market rate.

import rates, introduced a greater degree of uncertainty into the conduct of foreign trade.

Once functioning smoothly, auctions reduced friction and time consuming administrative red tape. Probably the most significant part of the reform was the fact that the multiple exchange rates in conjunction with the "Law of Similars" provided effective protection and subsidies to selected domestic industries. The Law of Similars has been a very potent instrument in quantitatively restricting imports. The law was designed to prohibit imports of products for which domestic supply is deemed to be adequate.[6] Gordon and Grommers noted that: "The experience of participating companies indicates that the operation of the law of similars has been a most powerful incentive for foreign investors to move from importing into assembly, or from assembly into full-fledged manufacturing."[7]

The 1953 system of exchange auctions and multiple rates was an improvement over the previous exchange regime of direct import licensing. It limited the extent of administrative abuses that were prevalent before 1953 and provided for a de facto devaluation of the cruzeiro rate on imports, while at the same time establishing a market mechanism for equating the supply and demand for foreign exchange.

In August, 1957 the Brazilian system of protection was reformed again. The original Tariff Law based on specific duties lost its protective effectiveness as a result of domestic inflation and was replaced by an ad valorem tariff schedule. In addition, the exchange system was streamlined--the five import categories were replaced by two, dubbed "general" and "special." The "general" category included imports of raw materials, equipment and other capital goods as well as general consumption goods considered essential. Most other goods considered not as essential were placed in the "special" category. This category included mainly consumer goods and those producer goods that were domestically available on a sufficient scale.

Auctioning of foreign exchange continued within the two exchange categories. The lowest and highest premiums actually obtained for the United States dollar at auctions held in Rio de Janeiro were as follows (see Table 6.2):

TABLE 6.2.--Exchange rates (cruzeiro per dollar).

Date	"General" category	"Special" category
Dec. 31, 1957	75-76	228
Jan. 27, 1959	227-249	351

Source: IMF, Tenth Annual Report on Exchange Restrictions, 1959 (Washington, D. C.), p. 59-62.

Special auctions were held for commodities placed in the most favored category. These high priority goods included fertilizers, newsprint, wheat and petroleum; the rate on these items at the end of 1957 was CR. 51.32 per dollar.

In the mid-1950's the protective system changed from one that was primarily intended to cope with recurring exchange shortages to a system geared to be a part of an overall strategy of industrialization of the Brazilian economy. Thus, the main purpose of the new Tariff Law of 1957 was to give adequate protection to the so-called "infant" industries.

B. The Height and Structure of the 1957 Brazilian Tariff and "Total" Protection

It is well known that there are serious empirical and conceptual problems in calculating the height of a country's tariff.[8] The use of unweighted average tariffs for this purpose is subject to the objection that it, in effect, assigns equal weights to items that differ in their relative importance in the country's import bill. Weighing the rate of duty by the country's own imports will result in an understatement of the average tariff. This is because low duties are generally associated with high levels of imports (i.e., large weights), and high rates that are most effective in curbing imports get low weights. A practical alternative would be to weigh a country's tariff rates by someone else's imports or by world trade in the affected commodities.

Yet, even if it were conceptually possible to devise a satisfactory set of weights, one still would not be measuring the effective protection accorded the manufacturing process. As several studies have pointed out, the protection accorded by tariffs is more appropriately given by the rate of duty on value added than by the nominal rate of duty levied on the value of imports.[9] While a nominal tariff acts as a subsidy to the domestic producer in the protected industries, tariffs levied on imported inputs used in production act as a tax. Thus, if the tariff on imported intermediate goods and raw materials is raised, the effective rate of protection of a given nominal tariff is reduced. In general, the effective rate will be higher than the nominal rate of duty if the final product bears a higher tariff than its inputs and vice versa.

While aware of these reservations I will nonetheless present some evidence regarding the height and structure of the Brazilian Tariff after the 1957 reform. Santiago Macario prepared a detailed comparison of the tariff schedules of eleven Latin American countries.[10] Using simple averages of the incidence of customs duties, Brazil ranked seventh in the sample of eleven Latin American countries in the 1957-59 period. When the weighted averages of tariffs were examined, using the value of a country's own imports as weights, Brazil's tariff ranked sixth relative to the same group of countries. The Argentinian and Paraguaian tariffs turned out to be the highest while Mexico and Uruguay had the lowest weighted average duties.

I have already noted that neither the simple averages of customs duties nor the tariffs weighted by a country's own imports results in an unbiased measure of the height of protection. Also, note should be taken that what appears as a highly protective average tariff could be partially offset by maintenance of an overvalued exchange rate and exchange control. By mitigating to some degree the restrictive effect of high import duties, an overvalued exchange rate amounts to an import subsidy. Bearing these considerations in mind, it is still evident from Macario's study that Brazil and most Latin American countries have a very restrictive system of protection.[11] The average incidence of unweighted tariffs for 125 products, including the cost of exchange in the "special" category, was 168 per cent for Brazil; in comparison, the average for the EEC was only 13 per cent.[12] This highlights the more restrictive nature of Latin American tariffs in general and that of Brazil in particular, relative to the tariffs of industrial countries.[13]

The structure of the Brazilian tariff differs from the EEC and other industrial countries in at least one important aspect. In general, there is a narrower differentiation between duties levied on goods corresponding to the different phases of the production process. High duties and charges are applied not only to final consumer goods, but also to raw materials (with the exception of fuels), capital goods and semi-manufactured products.[14] The heavy duties on raw materials and semi-manufactured goods reduce the degree of effective protection accorded by the Brazilian tariff to the finished goods.

Recently Clark and Weisskoff completed a detailed study of the structure of protection in Brazil. It is based on a sample of 463 imported commodities that cover between 85 to 90 per cent of the value of total imports.[15] My empirical work draws heavily on the Clark and Weisskoff study, as well as on my own calculations of Brazilian protection based on a smaller sample. Clark and Weisskoff carried out most of their analysis at a fairly aggregated level, i.e., combining their original sample into nine use classes. For the whole 1964 sample, tariff rates ranged from 0 per cent to 150 per cent, with slightly less than one-quarter of the rates being below 25 per cent and about the same proportion being above 75 per cent.[16] Within the nine use classes they found as expected that the durable and non-durable consumer goods had the highest average nominal tariff as well as the widest dispersion. Surprisingly high were the tariff averages for metallic and non-metallic intermediate products (47 per cent and 37 per cent respectively).[17]

As has been pointed out, the overall protection accorded a given product depends not only on the nominal tariff rates but also on the exchange premiums that varied according to the category in which the product was placed. This is demonstrated with respect to four products in Table 6.3. The combined tariff rates (nominal) and exchange protection (that will be referred to as "total" protection) in the Clark and Weisskoff sample ranged from -20 per cent to 380 per cent with almost one-quarter of the rates above 250 per cent about one-fifth below 50 per cent. The arithmetic mean of the whole sample was 183 per cent compared to 54 per cent for tariffs alone.[18] More importantly, the pattern of dispersion of this measure of "total" protection reveals a very high coefficient of variation for non-metallic intermediate products as well as for capital equipment used in industry and agriculture.

Table 6.4 gives an overall idea of Brazil's structure of protection according to use classes for the year 1964. It compares tariff rates and the combined protection of tariffs and exchange premiums.

TABLE 6.3.--Range of costs for one dollar's worth of imports into Brazil in March, 1958.

		Cruzeiro per U.S. dollar
Lowest cost--newsprint	Exchange rate (special subsidy)	22.32
	Tariff (free)	0.0
	Customs tax (5 per cent)	4.20
	Total	26.52
Moderate cost--copper "matte"	Exchange rate ("general" category)	75.00
	Tariff (10 per cent)	8.40
	Customs tax (5 per cent)	4.20
	Total	87.70
Medium cost--various iron and steel shapes	Exchange rate	75.00
	Tariff (60 per cent)	50.40
	Customs tax (5 per cent)	4.20
	Total	129.60
Highest cost--various special ornaments for automobiles	Exchange rate ("special" category	228.00
	Tariff (150 per cent)	126.00
	Customs tax (5 per cent)	4.20
	Total	358.20

Source: W. B. Dale, Brazil/Factors Affecting Foreign Investment (Menlo Park, Calif.: International Industrial Development Center, Stanford Research Institute, September, 1958), p. 52, Table 55.

Note: Calculations of tariff and customs taxes are based on the "fiscal" rate which at that time was 84 cruzeiros per dollar.

TABLE 6.4.--Tariff and exchange protection by use classes, 1964 (percentages).

Use Classes	Average tariff rate	Average tariff & exchange premiums
1. Non-durable consumer goods	38	152
2. Durable consumer goods	45	126
3. Fuels	41	16
4. Metallic intermediate goods	36	97
5. Non-metallid intermediate goods*	13 (23)	31 (67)
6. Construction materials	56	105
7. Capital equipment for agriculture**	9 (4)	40 (16)
8. Capital equipment for industry**	45 (18)	78 (31)
9. Capital equipment for transport**	35 (14)	85 (34)
Total Imports	32	58

Source: Clark and Weisskoff, "Import Demand and Import Policies in Brazil," U. S. Agency for International Development, Washington, D. C., February, 1967, p. 41, Table B-3. (mimeographed.)

Notes: Averages of nominal tariffs and tariffs plus exchange premiums by use classes, weighted by 1962 imports. Fuels had a lower "total" protection because of the special (i.e., subsidized) exchange treatment accorded petroleum products.

* Figures in parentheses exclude wheat.

** Figures in parentheses include a reduction of 60 per cent to represent crudely administrative reductions and waivers.

C. Tariffs and "Total" Protection Relative to the Brazilian Sample of Industries

While the aforementioned studies give an overall view of the height and structure of Brazilian protection, this is not entirely adequate for the purpose of my study. As I noted previously, this study calls for a comparison between the structure of protection and the skill composition of the country's industrial labor force. This correspondence will be attempted both for the tariff rates and "total" protection of industries.

1. Tariffs

I estimated the tariff protection accorded to products of 58 industries which reported wage, employment and output data in the Industrial Census of Brazil for the year 1959. Two "average" tariff rates corresponding to each of the 58 industries were computed.

In the first place I computed the simple (unweighted) average tariffs based on the different BTN categories used in the 1957 Tariff Law.[19] These rates remained essentially unchanged for the next two years.

Secondly, I computed a weighted average tariff for my sample of 58 industries. The problems encountered in obtaining an unbiased set of weights have been previously stated. This study used as weights the industrial countries' imports corresponding to each BTN heading. Mainly because they were readily available to me, I utilized the

United States and EEC imports under the BTN headings reported in a Committee for Economic Development study.[20] It has to be stressed that the use of Latin American imports as weights would have imparted the same downward bias to tariffs as would the use of Brazilian imports themselves.[21] In the absence of an "ideal" set of weights (i.e., the imports effectively kept out as a result of the tariff) it stands to reason that the use of the combined United States and EEC imports is an acceptable "second best" choice. During the 1958-60 period, the United States and EEC accounted for almost two-thirds of the combined exports of all industrial countries.

The statistics compiled by Santago Macario provided the unweighted average tariff rates for the year 1959.[22] For each of these measures of protection I computed the following summary statistics: The arithmetic mean, standard deviation and the ratio of the standard deviation to the arithmetic mean.[23] These statistics are found in Table 6.5. While the weighted average of the tariffs in my sample is lower than the simple average, the overall difference is not very great. The dispersion of these two measures is quite similar; however, the measure of relative variability is somewhat larger for the weighted average tariffs. Also it is evident from Table 6.5 that tariffs have remained largely unchanged between 1958 and 1959.

TABLE 6.5.--Summary statistics for tariff rate of 58 Brazilian industries (in percentages).

	Arithmetic mean	Standard deviation	Standard deviation / arithmetic means
Average tariff (unweighted)-1958	72.86	40.89	.561
Average tariff (weighted)-1958	63.97	44.71	.698
Average tariff (unweighted)-1959	70.55	37.47	.531

2. Overall Protection

In determining the overall protection accorded to the product of an industry, I considered the cost of purchasing foreign exchange in the two auction categories, i.e., "general" and "special." Neglect of the effect of exchange premiums in determining differential rates of protection may result in a severe understatement of the overall level of protection.

To obtain foreign exchange for non-preferred imports, an importer had to purchase an auction certificate valid for buying specific foreign currencies to pay for either "general" or "special" category imports. Possession of an auction certificate entitled the importer to purchase foreign exchange from the Bank of Brazil at the official selling rate. Thus, the effective rate for an imported good was obtained by adding to the official rate the price paid for the exchange certificate purchased at an auction. Auction rates varied widely depending on the currency and the category in which the imports were placed.[24]

With regard to the exchange premiums, I followed W. B. Dale in identifying whether <u>most</u> items produced by a given domestic industry were classified in the "special" or "general" category of imports. Then, computing the ratio of the given category rate to the "basic" rate determines the cost of exchange relative to the basic rate--essentially the lowest rate in the system (in practice I used the "general" rate). This measure also separates the protective effect of exchange premiums from the fluctuation in the "basic" rate relative to domestic prices in an inflationary environment.

The new Tariff Law was designed to share with the import auction system the task of restricting imports and protecting domestic industry. To value imports in order to apply the ad-valorem tariff rates to them, an exchange rate called the "fiscal" rate was fixed. Tariffs were applied to the cruzeiro value of imports converted at the fiscal rate. In practice this rate was based on the average rates prevailing in the auction markets for "general" category imports three months <u>prior</u> to the arrival of the goods. For example, in December, 1957 a conversion rate for customs purposes was 70 cruzeiros per dollar, while the rate in the "general" category was about 95 cruzeiros per dollar.[25] Since 1957 the fiscal rate remained below the actual rates paid by importers.[26] This led to tariffs being valued at rates below the "basic" exchange rate, thereby somewhat reducing their protective effect. In my measure of total protection (Formula 1) these discrepancies were included as part of the exchange premiums (i.e., reducing them) rather than as a decrease in the actual tariff rates applied.

With regard to the exchange premiums, my procedure has been to identify the exchange rate applied to the majority of products of each industry (the reader will recall that in 1959 the exchange categories were: "general," "special," and a separate one for government transactions). Next, following Clark and Weisskoff's procedure I have calculated the <u>actual</u> exchange premiums applied to the industry's product as a ratio of the "basic" rate. This makes all exchange premiums <u>relative</u> to what would have been the cost of exchange if imports were obtained at the "basic" rate.

In calculating the "total" protective effect of tariffs plus exchange premiums, formula (1), derived by Clark and Weisskoff, was used:[27]

$$(1) \quad TP = t \times f/r + c/r$$

Where: TP = "total" protection accorded the industry's product

t = average nominal tariff rate applied to the industry's product

f = fiscal exchange rate, i.e., the rate used in assessing tariff

r = "basic" exchange rate (defined as the "general" rate for 1958 and 1959)

c = unweighted average of category exchange rates

Figures obtained by this two-stage procedure can be interpreted as the percentage by which the prices of potential imports would exceed the prices of these same goods if they could be imported free of duty and at the "basic" exchange rate. The implicit assumption is that since the "world" supply elasticity of industrial products to Brazil is infinite, the domestic prices will rise by the per cent of the computed "total" protection. An alternative procedure would have been to compare world and domestic prices of the sampled industries' products to obtain the degree of protection. Regrettably no data are available on prices of domestic goods at the level of disaggregation used in this study.

The measure computed on the basis of formula (1) roughly presents the extent of protection accorded to the domestic industry producing these import substitutes. For this measure of "total" protection I computed the same summary statistics what were reported for the average tariffs (see Table 6.6).

TABLE 6.6.--Summary statistics of total protection for 58 Brazilian industries (percentages), 1958 and 1959.

	Arithmetic mean	Standard deviation	Standard deviation / Mean
Total protection 1958 (using arithmetic averages of tariffs)	197.8	89.6	.450
Total protection 1958 (using weighted averages of tariffs)	173.4	101.7	.586
Total protection 1959 (using arithmetic averages of tariffs)	196.2	80.94	.412

Source: See Data Appendix (Appendix D) for tariffs.

Notes: Total protection (TP) for each industry was computed from formula (1) TP = t x f/r + c/r (see p. 119). The ratios f/r and c/r were obtained from: Clark and Weisskoff, "Import Demands and Import Policies in Brazil," U. S. Agency for International Development, Washington, D. C., February, 1967, pp. 45-46, Tables B-5B and B-5C. (Mimeographed.)

The decision whether to classify a given industry as being subject to exchange purchased in the "general" or "special" category was based on information contained in: W. B. Dale, Brazil/Factors Affecting Foreign Investment (Menlo Park, Calif.: International Industrial Development Center, Stanford Research Institute, September, 1958), pp. 69-73, Appendix A: Brazilian Customs Tariff.

As outlined above, my procedure has the admitted shortcoming of concealing existing differences among commodities within a given industry group with regard to their exchange rate treatment. Given the nature of my data, I was only able to determine whether most of the industry's products belong to the "general" or "special" categories of exchange.[28]

D. Brazilian Structure of Protection and the Industries' Factor Intensities

1. Some General Considerations

It has been previously established that Brazil is deficient in skilled labor and capital relative to the United States and other industrial countries. Compared to its trading partners, Brazil is abundant in "nature."[29] Based on these factor endowments, Brazil "should" accord higher protection to those industries that employ a relatively greater proportion of its scarce factor--skilled labor--in production. These industries, as will be shown subsequently, are also the most physical capital intensive and pay higher average wages.

Several recent studies have dealt empirically with the nature of the relationship between labor earnings or "labor intensity" and the structure of protection accorded manufacturing industry. For the United States, Beatrice Vaccara found a positive association between the degree of tariff protection accorded an industry and a certain measure of the intensity of labor use.[30] Vaccara's examination of the average hourly wage structure of the protected industries revealed a negative correlation between the extent of protection and the average hourly wage rate.[31]

Later writers used effective instead of nominal tariff rates when testing for the existence of such an association. Basevi found a negative relationship between it and a measure of labor intensity of an industry.[32] In an earlier study Balassa computed the effective tariff rates for 36 manufacturing industries in the United States and several other industrial countries.[33] He did not find any significant correlation between a coefficient of labor intensity and effective protection.[34] Balassa's only statistically significant result was a negative rank correlation coefficient for Japan; for the United States he did not obtain the positive coefficient that would be theoretically expected. Balassa thought that his inability to find a positive correlation between labor intensity and effective protection showed the weakness of the Heckscher-Ohlin theory as the sole explanation of international trade patterns.[35]

Subsequently Ball pointed out that the weakness may not lie with the factor-proportion explanation of international trade.[36] Rather it is possible that the usefulness of Balassa's index of labor intensity is limited. The use of wage share in output as an indicator of labor intensity may be biased upward in the high wage industries, that are generally subject to low effective protection in the United States.[37] In turn Ball suggested that in order to test the hypothesis that the United States is protecting its relatively scarce factor (presumably unskilled labor), one ought to compare the industries' average wage to their effective rates of protection. When Ball tested whether there is an association between United States' effective tariff and average wages, he found a negative and statistically significant rank correlation coefficient.[38] This brought Ball to conclude: ". . . the 1962 U. S. tariff afforded heavier effective protection to lower wage industries and lesser effective protection to higher wage industries."[39] This is in accord with the Heckscher-Ohlin hypothesis, i.e., if unskilled labor is America's scarce factor, then the industries using it more intensively should be the subject of higher protection.

To my knowledge no such verification has been attempted for an underdeveloped country. My data enabled me to test whether a definite relationship exists between the degree of protection accorded manufacturing industries in Brazil and their indexes of labor intensiveness. In the following table (Table 6.7) my results and the

TABLE 6.7.--Rank correlation coefficients between protection and wages, Brazil (1958, 1959) and the United States (1962).

	Brazil nominal tariff--20 industries (1959)	Brazil total protection--20 industries (1959)†	Brazil nominal tariff--59 industries (1958)††	Brazil total protection--58 industries (1958)†	U.S. effective tariff--31 industries (1962)
Average annual wages of all employees	-.664*	-.726*	-.439*	-.509*	-.568*
Average annual wages of production workers	-.663*	-.689*	-.581*	-.669*	-.685*
Wages' share of value added by manufacturing	+.301	+.358	n.a.	n.a.	+.025

Sources: The U.S. statistics are from Ball, "United States Effective Tariffs and Labor's Share," Journal of Political Economy, LXXV (April, 1967), 184, Table 1.

Total protection includes average nominal tariffs; see: Macario, "Protectionism and Industrialization in Latin America," Economic Bulletin for Latin America, IX (March, 1964), 61-101, plus exchange premiums; see: Clark and Weisskoff, "Import Demand and Import Policies in Brazil," U.S. Agency for International Development, Washington, D. C., February, 1967, p. 45, Table B-5B. (Mimeographed.)

The Brazilian wage data are included in the Data Appendix (Appendix D).

Notes: * Significant at the one per cent level.
†† Average weighted tariff--see previous section of this chapter for explanation.
† Total protection includes weighted average tariff plus exchange premiums.

corresponding Balassa-Ball results are shown. Table 6.7 includes results based on two samples of Brazilian industries. The first sample includes 20 major industry groups while the second sample includes the earning's and protection characteristics of 58 smaller industries obtained from the Brazilian Industrial Census of 1960. The rank correlation coefficients for the two groups of Brazilian industries were calculated with nominal tariffs and total protection rates, instead of effective tariffs used by Ball and Balassa. For the sake of comparison, I included in Table 6.7 the results for the United States as computed by Ball.

Figure 6.1 illustrates the apparent inverse relationship between average "wages" of production workers and nominal tariffs.[40] The inference that can be drawn from Table 6.7 and from reading the scatter diagram (Figure 6.1) is that the Brazilian structure of protection (both tariffs and exchange premiums) accords relatively heavier protection to low wage industries. This is contrary to expectations since unskilled labor is the countries' abundant factor. I was unable to find a significant relationship between the share of wages in value added and the extent of protection accorded to the products of 20 industries. I was struck by the similarity of the structure of protection of Brazil, an underdeveloped country, and the United States, a highly

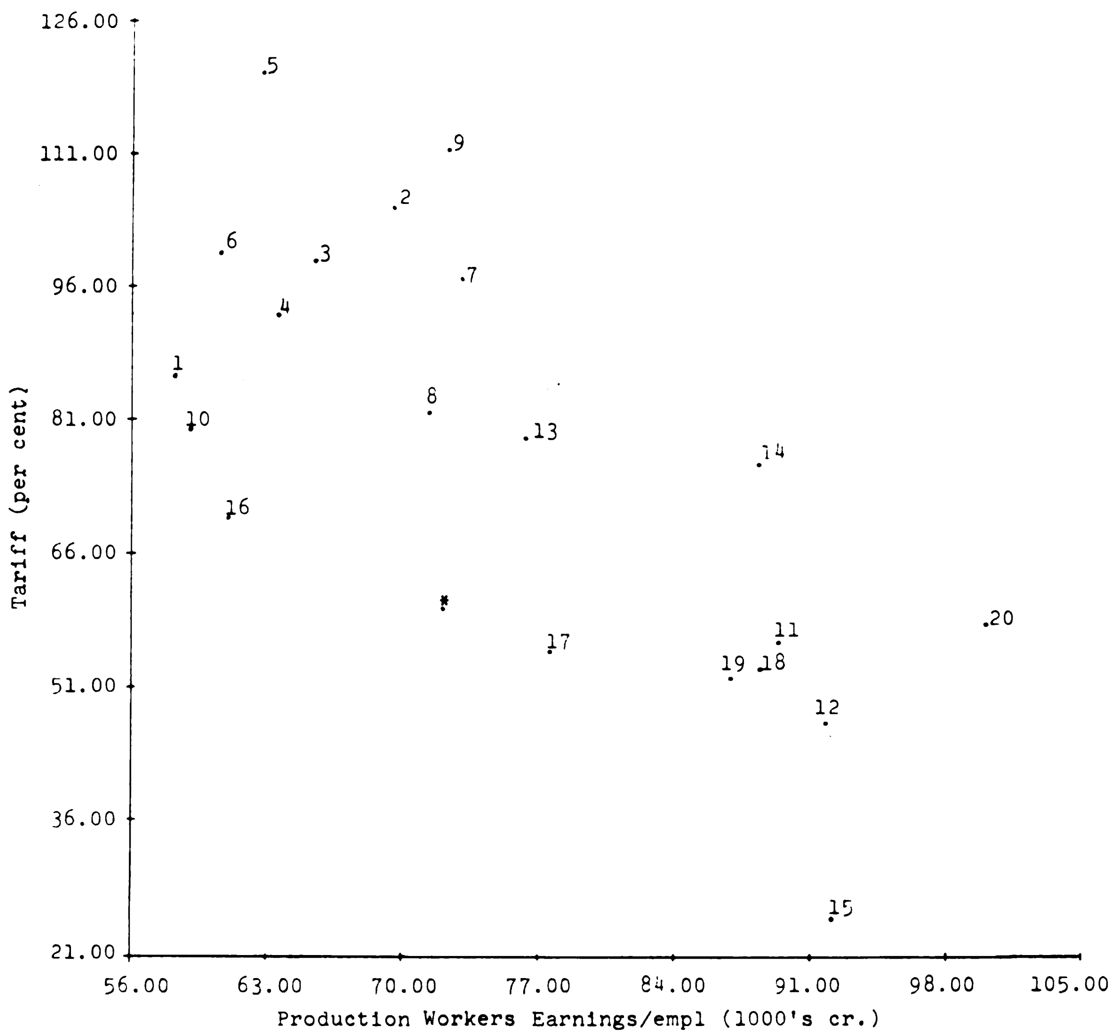

Figure 6.1.--Tariffs and production workers' average earnings in Brazilian manufacturing industry by major industry groups, 1959.

Source: See Data Appendix.
Notes: Names of the industry groups:

1. Lumber
2. Furniture
3. Furs & skins
4. Textiles
5. Clothing
6. Food
7. Beverages
8. Tobacco
9. Miscellaneous
10. Non-metallic minerals
11. Metallurgical
12. Mechanical
13. Paper & paper products
14. Rubber
15. Chemicals
16. Perfumes
17. Plastics
18. Editorial & graphic
19. Electrical & communication equip.
20. Transportation equipment

*Average of all manufacturing industries (the 20 included above).

industrialized country. This is paradoxical in the light of what must be a generally accepted wide disparity between the two countries' "man-made" factor endowments (i.e., human and "physical" capital).

2. Skill Composition, Capital Intensity and Protection across Brazil's Industries

Given the paradoxical results reported in Section D-1, it is necessary to proceed with a more complete analysis of the relationship between industries' factor intensities and the structure of their protection. Specifically, I will examine the relationship between the industries' skill intensity and the protection accorded their product.

In Chapter IV, Hal B. Lary's method was used to approximate the flow of human and "physical" capital into the industries' output.[41] In that context value added by manufacture was employed as a reasonable index of the aggregate flow of man-made resources into the production process. Value added for each Brazilian industry was obtained by subtracting the value of "materials" (that included raw materials, supplies, fuel, electric energy consumption, cost of resales and miscellaneous receipts) from the value of shipments. Subsequently, value added in each industry was broken into two components: (1) wages and salaries and (2) the remainder--the non-wage component of value added. Both 1 and 2 were deflated by the number of production workers in each industry. Thus, the industries' value added was ascribed to both human and "physical" capital. The wage-and-salary component of value added was taken as a reasonable proxy for the flow of human capital into the production process, while the non-wage-salary component was taken as a proxy for the contribution of "physical" capital to the production process.

Based on these indexes of human and "physical" capital, Lary's procedure was followed in arraying the 20 Brazilian manufacturing industries relative to all transformation industries. To examine their relative factor intensities, I divided the 20 major industries into four groups.

Group I industries (south-western corner in Figure 6.2) use unskilled labor intensively. Typically, these industries are below the average in terms of wages and capital per worker. In 1959, Group I included the following industries: textiles, clothing, lumber and wood products, furs and skins, furniture and non-metallic minerals.

Group III industries (north-eastern corner) are intensive in skill (human capital) and physical capital relative to the average of all transformation industries. They are characterized by high average wage as well as high non-wage value added per employee. Group III included the following industries: transportation,

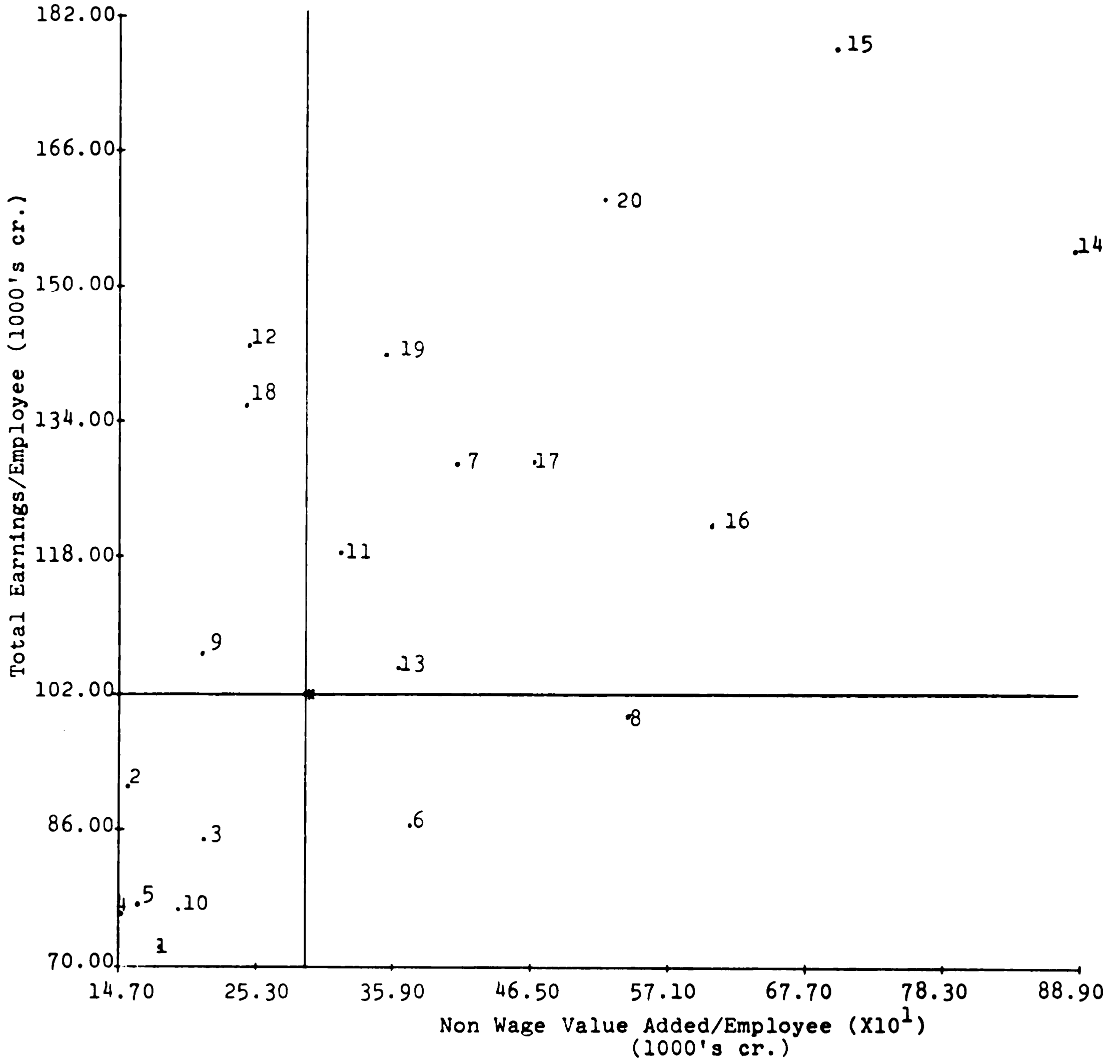

Figure 6.2.--Wage and non-wage value added per employee by major industry groups in Brazil, 1959.

Source: See Date Appendix.
Notes: For names of industry groups see Figure 6.1.

*Average for all manufacturing industries.

electrical and communications equipment, chemicals, plastics, perfumes, rubber, metallurgy, beverages and paper.

The remaining industries can be divided roughly into two groups. Group II (south-eastern corner) includes the tobacco and food industries. They have a higher than average ranking in non-wage value added, but rank low on the average wage scale. Finally, Group IV (north-western corner) is characterized by higher than average wages; it includes mechanical, editorial and graphic and miscellaneous industries. They are somewhat below the average in the non-wage value added per employee. Miscellaneous industry is on the border between Group I and IV and can be described as unskilled-labor intensive.

Lary ranked the major United States industries on the basis of the wage and non-wage components of value added for 1965.[42] The similarity of the two rankings presumably reflects the absence of factor intensity reversals between the two countries.[43] Harry Johnson noted that Lary's index of overall factor intensity may reflect, in addition to human and physical capital inputs, also some neo-technological factors, i.e., economies of scale, product age and differentiation; to the extent that those are reflected in the final goods' selling price.[44]

Is there any justification for using the non-wage value added instead of the more commonly used capital-labor ratio? Lary argues that it may be preferable to use the "flow" concept of capital whenever dealing with the contribution of a factor input to the industry's production of goods and services.[45] This will be a more inclusive concept than the conventionally used capital-labor ratio. Some components of the non-wage value added figure are quite closely associated with the physical "stock" of capital; for example, rent, interest payments on borrowed capital and payments to proprietors and partners. Other expenditures, such as those related to advertising, legal services and travel, I will assume to be randomly distributed among industries, since no detailed information is given on their breakdown.

Next, I proceeded to test statistically whether inter-industry differences in non-wage value added accurately reflect the "physical" capital intensity, as indicated by the industries' capital-labor ratio. The Brazilian Industrial Census provided the data on fixed physical assets for twenty industry groups in 1959. The reliability of the capital assets series is questionable because it combines data on equipment, buildings, and land acquired at different times and at different prices. Despite these reservations, my results support the assertion that a significant association exists between non-wage value added per employee and physical assets per employee (the capital-labor ratio). The correlation coefficient of these two variables is .677 significant at one per cent. Using a logarithmic transformation of the same variables, the relationship is even more pronounced, yielding a correlation coefficient of .727 significant at one per cent.[46]

Finally, I attempted to determine whether a systematic relationship exists between the skill composition of Brazil's industries and the extent of their protection. In order to achieve such a comparison, I devised in Chapter IV an appropriate measure of the human-capital intensity of an industry and expounded its rationale.

By employing skill indexes II and III, I wanted to establish whether the industries that are human capital intensive also use relatively large proportions of "physical" capital. In effect, the inquiry was whether the two "factors" are used in cooperation to produce a high "overall" factor intensity in certain industries. As was noted by Hufbauer, skill-intensive goods are likely to overlap with capital-intensive goods, because the acquisition of both human skills and of "physical" capital involves acts of investment (and saving). Therefore, I inquired into the nature of the relationship between inter-industry differences in capital intensity--measured as a flow or a stock--and the skill-index of the sample of 20 industries. As reported in Table 6.8, a significant and positive correlation (though not very high) has been obtained between the two skill-indexes and the "physical" capital intensity of Brazilian industries.

TABLE 6.8.--Correlation coefficient between capital intensity of 20 Brazilian industries and skill indexes--1959.

	Skill index-II	Skill index-III
Non-wage value added per production worker	.556** (2.836)	.681* (3.336)
Gross capital assets per production worker	.688* (4.026)	.691* (4.059)

Source: See Data Appendix (Appendix D).

Notes: Numbers in parentheses, below correlation coefficient, are the corresponding t-value.

* Significant at one per cent.
** Significant at five per cent.

Finally, I resumed the empirical examination of the relationship between the human-skill intensity of different industries and the level of protection accorded the industries' product. Two measures of protection were used--the average nominal tariffs and the measure of total protection, i.e., the combination of tariffs and exchange premiums that have been derived earlier in this chapter. From Table 6.9 and Figure 6.3 the negative relationship between skill indexes-II and III and the industries' level of protection becomes apparent.

Based on these findings it is therefore possible to conclude that the Brazilian industries containing a high proportion of skilled labor also have a high capital-labor ratio, measured either in stock or flow terms.[47] Furthermore, the structure of Brazilian protection bears a unique

TABLE 6.9.--Correlation coefficients between tariffs and total protection and skill indexes for 20 Brazilian industry groups, 1959.

	Skill index-II	Skill index-III
Average nominal tariffs	-.635* (3.491)	-.665* (3.783)
Total protection (tariffs plus exchange premiums)	-.704* (4.215)	-.751* (4.830)

Source: See Data Appendix (Appendix D).

Notes: Numbers in parentheses below correlation coefficient are the co-responding t-value.

* Significant at one per cent.
** Significant at five per cent.

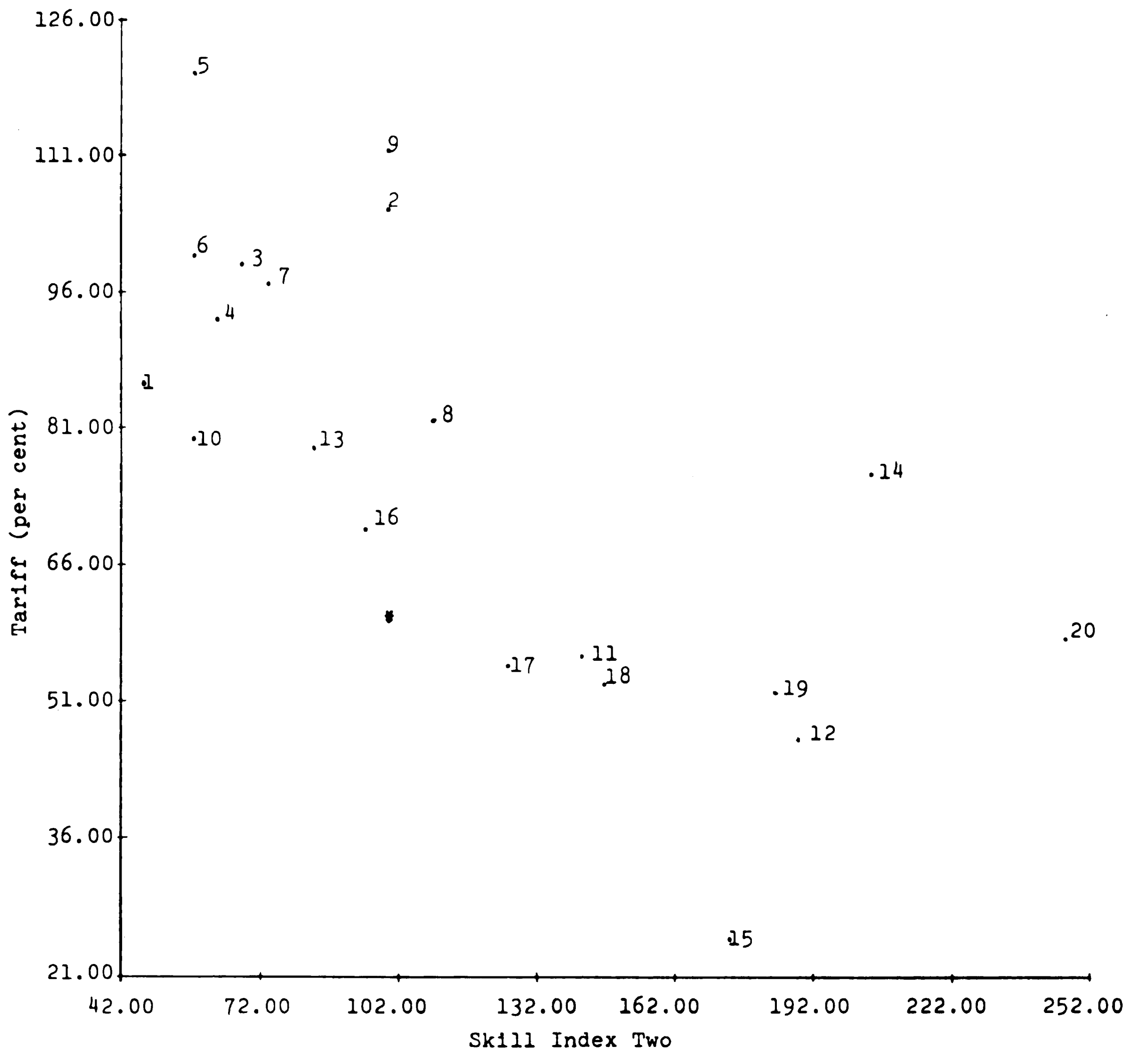

Figure 6.3.--Skill indes-II and average nominal tariff rates of 20 industry groups in Brazil, 1959.

Source: See Data Appendix.
Notes: For names of industry groups see Figure 6.1.

*Average for all manufacturing industries.

relation to what I defined as the industries' skill quotient or skill index. Brazil accords relatively heavy protection to those industries that have a low skill content--industries characterized by a high proportion of unskilled labor relative to human and physical capital. This must be termed a paradoxical result in light of the extremely unequal distribution of skill or human capital between Brazil and its main trading partners, the United States and Western Europe. In Chapters III and IV, I have concluded that Brazil is a human capital "poor" country compared to its main trading partners, and that she reflects this economic reality in her commodity trade. The country is a net importer of skill intensive commodities and exports goods that are "nature" and unskilled labor intensive.[48]

Hufbauer's and my calculations accounted for only the direct factors going into the final productive processes. One can question whether indirect inputs should be included, such as those used in producing the materials that go into the final good. First, I found no evidence to suggest that even if it were possible to account for indirect factors, there would be any serious reversals of the major conclusions. Secondly, and more importantly, when considering industries' comparative advantage, materials not possessed by a country can usually be obtained in international trade. A labor abundant country, for example, producing and exporting a labor intensive good (such as cotton textiles) can import the needed modern machinery, though that equipment itself may be capital-intensive. In fact, to include indirect factors in such cases does not fit with the very purpose of explaining international specialization and trade. The problem of material inputs may loom important especially in the food processing industry. In these instances the location of the processing industries is determined more by the availability of the "raw" materials (often perishable) than the relative requirements of capital and labor used in their processing. At least for these types of industries the investigation ought to be pushed back to find out what determines the production characteristics of these material inputs.

Brazil, and other skill deficient countries, rely on their commodity trade to supplant their relative scarcity of human capital.[49] Thus, for Brazil a theoretically "correct" structure of protection should accord relatively high protection to those industries that use the country's scarcest factor intensively, i.e., the human capital intensive industries. In fact, one finds that Brazil accords relatively high protection to its unskilled labor intensive industries like the textile, clothing and leather industries. In Chapter VII the effect of the structure of Brazilian protection will be incorporated into a more general discussion of wage determination in Brazilian industry.

FOOTNOTES: CHAPTER VI

[1]For complete analysis of the operation of exchange controls in Brazil consult: Donald Huddle, "Furtado on Exchange Control and Development: An Evaluation and Reinterpretation of the Brazilian Case," Economic Development and Cultural Change, XV (April, 1967), 269-85.

[2]The overvalued exchange rate, in effect, subsidizes selected imports. A number of goods considered essential, such as drugs, insecticides and fertilizers could be imported freely. Fuels, some foodstuffs, cement and paper and printing equipment received priority in obtaining licenses. Next in the order of priorities came the machinery and equipment needed for modernization of industry. The goods considered non-essential by the government were closely restricted. The incentive feature of the licensing system was limited to assemblers and manufacturers, who had to rely on imports of components and raw materials, although the latter theoretically had priority over finished goods.

[3]Official Instruction No. 70 of SUMOC (Superintendencia da Moeda e Credito) as ratified by laws 2145 and 2410 of December, 1953 and January, 1955.

[4]For detailed discussion of the actual operation of the exchange auction system see: Donald Huddle, "Disequilibrium Systems, Industrialization and Inflation: The Brazilian Case" (unpublished paper no. 30; Yale University, Economic Growth Center, July 17, 1967).

[5]International Monetary Fund, International Financial Statistics, VIII (February, 1955).

[6]A special agency was set up to determine whether domestic suppliers could furnish a given product in "sufficient" quantity and acceptable quality. If a positive determination was made, the good was registered as a similar, and its importation was discouraged or totally banned.

[7]L. Gordon and E. L. Grommers, United States Manufacturing Investment in Brazil: Impact of Brazilian Government Policies, 1946-1960 (Cambridge, Mass.: Harvard University Press, 1962), p. 23.

[8]M. E. Kreinin, Alternative Commercial Policies: Their Effect on the American Economy, Institute for International Business and Economics Studies (East Lansing, Mich.: Michigan State University, 1967), pp. 34-37.

[9]Among several recent studies see for example: W. M. Corden, "The Structure of a Tariff System and the Effective Protective Rate," Journal of Political Economy, LXXIV (June, 1966), 221-37, also Balassa, op. cit., 573-94, also H. Johnson, "The Theory of Tariff Structure with Special Reference to World Trade and Development," Trade and Development (Genèva, 1965), also G. Basevi, "The United States Tariff Structure: Estimates of Effective Rates of Protection of U. S. Industries and Industrial Labor," Review of Economics and Statistics, XLVIII (May, 1966), 147-60.

For a recent contribution in which some of the restrictive assumptions often made with respect to effective tariffs are relaxed see: J. Clark Keith, "Substitution and Supply Elasticities in Calculating the Effective Protective Tariff," Quarterly Journal of Economics, LXXXII (November, 1968), 588-601, also William P. Travis, "The Effective Rate of Protection and the Question of Labor Protection in the United States," The Journal of Political Economy, LXXVI (May/June, 1968), 443-61.

[10]Santiago Macario, "Protectionism and Industrialization in Latin America," Economic Bulletin for Latin America, IX (March, 1964), 61-101.

[11]For example, the overall unweighted averages of import duties at the beginning of 1960 were: 151 per cent in Argentina; 93 per cent in Chile and 60 per cent in Brazil. In contrast, the corresponding incidence for France--a high tariff country--was only 18 per cent. See: Ibid., 73, Table 4.

[12]See Table 6.10, p. 139 for details on the incidence of the tariffs in Brazil, Argentina, Chile and the E.E.C., based on commodity groups.

[13]The correspondence between the EEC and United States Tariff rates is quite close for most commodities. The major difference is that EEC tariffs on food products are higher relative to the United States; while on non-food imports tariffs are somewhat higher in the United States.

For detailed study see: Committee for Economic Development, Trade Negotiations for a Better Free World Economy: A Statement on National Policy by the Research and Policy Committee (New York: Committee for Economic Development, 1964), Appendix B, pp. 67-78.

TABLE 6.10.--Simple arithmetic means of duties and charges applied in three Latin American countries and EEC's External Tariff (in percentages), 1960.

Category and Group	Argentina	Brazil	Chile	EEC
Category I: Primary commodities and capital goods (51 products)	96	134	58	13
1. Nonprocessed foodstuffs (13 products)	123	264	46	21
2. Industrial raw materials (10 products)	55	106	111	1
3. Capital goods (28 products)	98	84	45	13
Category II: Semi-manufactured and durable goods (43 products)	139	143	96	10
1. Semi-manufactured goods (32 products)	95	80	98	7
2. Durable consumer goods (11 products)	266	328	90	19
Category III: Current Consumer Manufacturers (31 products)	176	260	328	17
1. Processed foods (14 products)	192	280	436	19
2. Others (17 products)	163	244	239	15
Overall average (125 products)	131	168	138	13

Source: S. Macario, "Protectionism and Industrialization in Latin America," Economic Bulletin for Latin America, IX (March, 1964), 75, Table 5.

Notes: This table includes in addition to the duties and charges applied by Brazil also the customs clearance tax (about 5 per cent for most products) and the higher cost of foreign exchange for imports classified in the "special" category. For Chile the charges include the supplementary tax or cost of financing the prior deposits.

[14]For details consult: Macario, op. cit., 77.
On the structure of the European tariff consult: United Nations Commission for Europe, Committee on the Development of Trade, Report on the Special Meeting on the Organization and Techniques of Foreign Trade, June 29-July 3, 1959 (Geneva: United Nations, 1959), Annex IV.

[15]Clark and Weisskoff, op. cit.

[16]Ibid., p. 5.

[17]Ibid., p. 39, Table B-2A.

[18]Ibid., p. 40, Table B-2B.

[19]The basic data on tariffs are included in: Law no. 3.244, Tarifas das Alfandegas, issued August, 1957.

[20]That study reports the EEC and United States imports for 1959 and 1960. See: K. F. Topping, Comparative Tariffs and Trade (New York: Committee for Economic Development, March, 1963).

[21]The Macario study established the existence of similarity in the structure of all of Latin American tariffs (including that of Brazil). His conclusion is that ". . . the structure of import duties and charges in most of the Latin American countries is characterized by its lack of rationality and by the prevalence of excessively high rates, as regards both average levels and those applicable to the vast majority of individual products." See S. Macario, op. cit., 67.

[22]From: Ibid., Annex II, Table B.

[23]For a discussion of these summary measures see: W. I. Greenwald, Statistics for Economics (Columbus, O.: Charles E. Merrill Publishers, 1963), Chapter II.

[24]There were two main currencies and several subsidiary currencies that were purchased at these periodic auctions. These were the United States dollar and the "ACL dollar," the latter refers to certificates provided for under a multilateral trade and payments agreement between Brazil and certain Western European countries. Allocation of exchange within the system generally made non-dollar imports cheaper and also imports in the "special" category were much more expensive than those in the "general" category. See: Dale, op. cit., pp. 48-50.

[25]Taken from: IMF, Ninth Annual Report on Exchange Restrictions, 1958 (Washington, D. C.: IMF, May, 1958) pp. 61-64.

[26]Clark and Weisskoff, *op. cit.*, p. 45, Table B-5B.

[27]*Ibid.*, p. 21.

[28]The classification of each industry's product in the "general" or "special" exchange category was based on: Dale, *op. cit.*, Appendix A: Brazilian Customs Tariff, pp. 69-73.

[29]I take the term "nature" to mean relative abundance of unskilled labor and certain natural resources. The argument can be legitimately extended to most industrial countries with whom Brazil's commodity trade is concentrated. First, the tariff structure of the United States and other industrial countries were found to be quite similar. See: Balassa, *op. cit.*, 586.

Second, industrial wage structure among developed countries also exhibits striking similarities. For empirical evidence on this consult: I. B. Kravis, "Availability and Other Influences on the Commodity Composition of Trade," Journal of Political Economy, LXIV (April, 1956), 143-55; also: D. S. Ball, "United States Effective Tariffs and Labor's Share," Journal of Political Economy, LXXV (April, 1967), 186.

[30]Mrs. Vaccara grouped protected industries into five protective classes ranging from "unprotected" (Class I) to "heavily protected" (Classes 4a and 4b). Her classification is based on both the proportion of each industry's output that is protected and also, according to the average ad valorem tariff applied to the industry's product. The measure of labor use is the number of employees per million dollars of shipment of an industry. Labor cost is measured as the ratio of wages and salaries to the value of shipment.

Beatrice N. Vaccara, Employment and Output in Protected Manufacturing Industries (Washington, D. C.: The Brookings Institute, 1960).

[31]As shown in Table 6.11, p. 142, the most heavily protected classes, 4a and 4b, had average wages about 11 per cent below that of the "unprotected" classes.

TABLE 6.11.--Average hourly wages of industries classified according to protective classes, 1954.

Protective classes	Average hourly wage rate (dollars)
1	1.81
2	1.81
3	1.86
4a	1.76
4b	1.61
All classes	1.68

Source: Beatrice N. Vaccara, Employment and Output in Protected Manufacturing Industries (Washington, D.C.: The Brookings Institute, 1960), pp.61-62.

[32]Basevi objected to use of nominal tariffs and labor intensity, arguing that Vacarra's study failed to take into account the existence of intermediate inputs. See: Basevi, op. cit., 157-59.

[33]Balassa, op. cit., 573-94,

[34]Balassa's measure of labor intensity is: The share of wages plus employer-financed social security payments in the value of output. Ibid., 581, Table 2.

[35]Ibid., 585.

[36]Ball, op. cit., 183-87.

[37]As Ball pointed out, the usefulness of the Balassa index of labor intensity depends crucially on the assumption that homogenous labor is employed at equal wages in all industries. Ibid., 184.

[38]For the United States, the average wages for the low tariff group, i.e., industries with effective tariffs of less than 20 per cent, were higher than the national average and were about $1,600 higher than the average wages for the high tariff group. Ibid., 185-85.

[39]Ibid., 186.

[40]Figure 6.4, p. 145, shows the relationship between total protection and labor earnings in Brazil.

[41]Lary, op. cit.

[42]Ibid., pp. 20-22.

[43]The overall similarity of the rankings of industries according to Lary's indexes of skill and capital intensity is apparent from Table 6.12, p. 145 for the two countries. The few discrepancies that do exist present an interesting exception to what otherwise is quite a similar pattern. For instance, the rubber industry in the United States is equal to the average United States industry in terms of the wage and salary component of value added and is somewhat below the United States average in terms of physical capital intensity. In Brazil the rubber industry is highly intensive in both human skill and physical capital. This may indicate that the production of tires and tubes, which figures prominently among rubber products, is less amenable for substitution of unskilled labor for capital.

On the other hand, the non-metallic minerals industry--stone, clay, cement and glass products--may leave more room for substituting unskilled labor for capital in an underdeveloped country like Brazil. In fact, I note that in Brazil this industry uses a relatively high proportion of unskilled labor, while in the United States it is close to the average both in skill content and capital intensity. Another industry group that warrants a comment is the electrical equipment industry. This industry is lower in skill intensity or human capital than the average United States manufacturing industry, but is somewhat above the average in physical capital. In Brazil the electrical equipment industry is ranked as both skill and physical capital intensive. This may represent the adoption of relatively advanced foreign production techniques that result in a high proportion of capital or skill in value added, and leave small room for substitution of unskilled labor for capital or skilled labor. In spite of the cases discussed above, it is evident that the overall pattern found for the United States concerning value added per employee and its wage and non-wage components is observed for Brazil as well.

Ibid., p. 21, Chart I.

[44]Harry G. Johnson, "The State of Theory in Relation to the Empirical Analysis," NBER Conference on Technology and Competition, October, 1968, p. 9. (Mimeographed.)

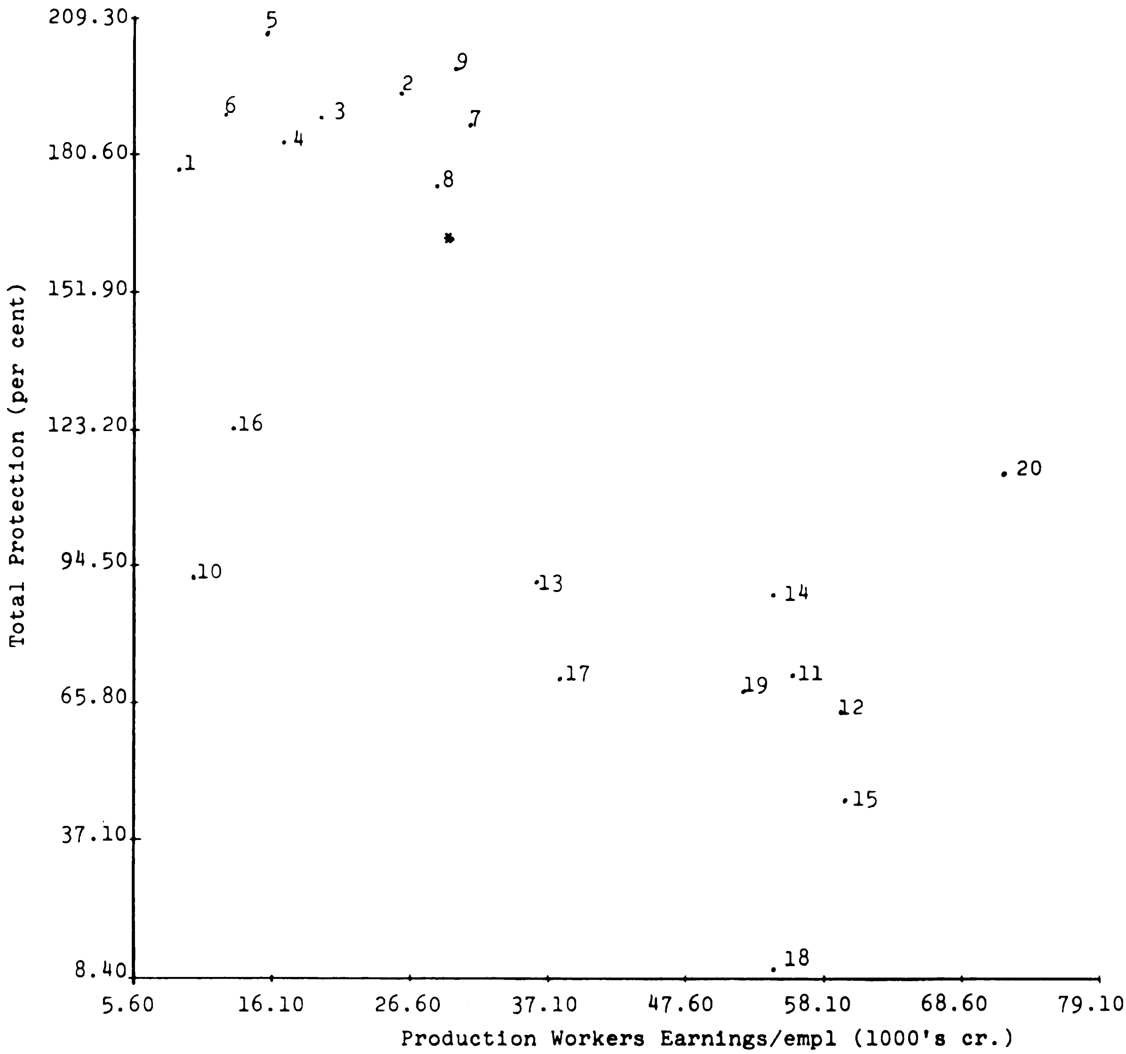

Figure 6.4.--Total protection and production workers' average earnings in Brazilian Manufacturing Industry by major industry groups, 1959.

Source: See Data Appendix.
Notes: For names of industry groups see Figure 6.1.

*Average for all manufacturing industries.

TABLE 6.12.--Array of United States industries (1965) and Brazilian industries (1959) based on wage and non-wage value added per employee.

	U.S. manufacturing industries by major industry groups 1965*	Brazilian transformation industries major industries 1959
Group I (low skill and low capital per employee)	Apparel & related products (23)	Clothing and related products
	Leather and leather products (31)	Furs and skins
	Lumber and wood products (24)	Lumber and wood
	Textile products (22)	Textiles
	Furniture and fixtures (25)	Furniture
	Miscellaneous manufacture (39)	Non-metallic minerals
	Rubber and plastics (30)	
Group III (high skill and high capital per employee)	Petroleum and coal products (29)	Rubber
	Chemical and allied products (28)	Chemicals and pharmaceuticals
	Instruments & related products (38)	Plastics
	Transportation equipment (37)	Transportation equipment
	Primary metal industry (33)	Metallurgicals
	Paper and allied products (26)	Paper and paper products
		Perfumes
		Electrical and communications eq.
		Beverages
Group II (low skill but high physical capital per employee	Tobacco manufacturers (21)	Tobacco
	Food and kindred products (20)	Food
	Stone, clay and glass products (32)	
Group IV (high skill but low physical capital per employee)	Machinery (except electrical) (35)	Mechanical industries
	Printing and publishing (27)	Editorial and graphic
	Fabricated metals (34)	Miscellaneous products
	Electrical machinery (36)	

Source: Ranking of U. S. manufacturing industries--Hal B. Lary, Imports of Manufactures from Less Developed Countries, National Bureau of Economic Research (New York: Columbia University Press, 1968), pp. 21-30, Chart I and and Table II. Ranking of Brazilian transformation industries, see Chart I.

Notes: * The numbers in parenthesis are the SIC code for each industry group.

Rubber and plastics for U. S. are on the border of group I and IV.

Miscellaneous products are on the border of group IV and I.

[45]Lary also notes other problems when using capital stock figures: "The uncertainty regarding the stock figures is compounded by the familiar vintage problem, i.e., the fact that available data on capital assets include equipment and buildings acquired at various times past and at different price levels and written down according to depreciation practices varying among industries and influenced by changing tax laws." Lary, op. cit., p. 41.

[46]Unfortunately no data on capital assets were reported in the Brazilian Industrial Census for the larger sample of 58 industries. I attempted to use the installed power capacity (horse-power) per employee for these various industries as a possible measure of capital intensity. The outcome was that I found no significant association between installed power capacity per employee and non-wage value added per employee.

The data were taken from: IBGE--Serviço Nacional de Recesnseamento, Censo Industrial de 1960, Brazil, p. 6.

[47]Unfortunately the data needed to compute the skill indexes for my larger sample are not reported in the Brazilian Census; thus, I am unable to test these relationships for the extended sample.

[48]Many students of economic underdevelopment claim that the most blatant scarcity of underdeveloped countries is in human capital, i.e., in terms of their skill deficiencies. Therefore we may see in the future reduced emphasis on merely the amounts of physical capital flowing into the underdeveloped countries.

The following remark by Schultz is pertinent in this respect, "This one-sided effort is under way in spite of the fact that the knowledge and skills required to take on and use efficiently the superior techniques of production, the most valuable resource that we could make available to them, is in very short supply in these underdeveloped countries. Some growth of course can be had from increase in more conventional capital, but the rate of growth will be seriously limited. It is simply not possible to have the fruits of a modern agriculture and the abundance of modern industry without making large investments in human beings [my italics[." T. W. Schultz, "Investment in Human Capital," American Economic Review, LI (March, 1961), 16.

In recent years, in marked contrast with the 1950's, we can observe an added emphasis on technical assistance, training programs, health programs, educational loans and other contributions to human capital.

[49] Keesing found that one billion dollars of India's 1962 exports required in their production 72 per cent unskilled labor and only about .7 per cent of highly skilled labor. The United States, on the other hand, has the most skill-intensive exports, and also showed the greatest abundance of hard to acquire skills. [U.S. exports included 5 per cent skilled and 45 per cent unskilled labor.]

Keesing, "Labor Skills and Comparative . . .," <u>op. cit.</u>, 254-55, Table 1.

CHAPTER VII

INTER-INDUSTRY WAGE DIFFERENTIALS AND THEIR RELATION TO PROTECTION IN BRAZIL

A. Introduction

This part of the study inquires into the determinents of inter-industry wages and wage changes in Brazil's manufacturing sector. More specifically, it deals with changes in the industries' protection brought about by the 1957 Tariff Law, and the effect of these changes on the earnings of the industrial labor force. I will attempt to determine empirically whether the changes in protection resulting from the 1957 Tariff Law had the "normal" protective effect as postulated by Stolper and Samuelson. Specifically, I am investigating whether the new Tariff acted to raise the renumeration of Brazil's scarce factor of production--skilled industrial labor.

Using the method of multivariate regression analysis, I will test for the effects of tariff and total protection changes on the earnings of a cross section of manufacturing industries. Part B of this chapter gives the theoretical rational for the selected independent variables included in the regression equations. Part C details the various forms of the regression runs. And finally, Part D includes a summary and an economic interpretation of the statistical results.

B. The Determinants of Inter-Industry Wages: The Theoretical Rationale for Selected Variables

Industrial wage structure is the end result of numerous factors, some of which are "market" determined while others are dependent on institutional considerations. Wages, as well as returns to other factors, fulfill the double role of allocating resources and of affecting the income distribution. As a response to changes in market demand and supply functions, wage changes, in their allocative role, act to redistribute labor. This results in the bidding up of factor prices, including wages, in the expanding industries while factor payments will generally lag behind in the declining or stable industries.

According to the neoclassical price theory, wages will be determined by the value of the marginal product of labor. The fundamental behavioral assumption underlying the neoclassical model is that the firm's decision makers have a single goal motivating them, i.e., profit maximization. The model also implicitly assumes that the firm possesses perfect information about the nature of its revenue, production and cost functions. Under these assumptions the firm decides how much to produce and the amounts of factors to purchase by equating the various factor price ratios to the relevant factor-product combination (i.e., the value of the marginal product). Thus the demand curves for factors are derived from the relevant production functions on the assumption of profit maximazation. However, the value of the average product (i.e., the value added per production worker man-year in this study) is systematically related to the value of the marginal product over the "usual" range of labor use.[1] Thus changes in the value of the average product of labor are influenced by both productivity and price changes.[2]

Several recent studies have shown that earnings of labor will vary with the degree of concentration and profitability of industries.[3] These findings are in accord with what has been termed the "ability to pay" hypothesis, which suggests that the more profitable industries are more likely to pay higher wages. D. G. Brown, the major proponent of this hypothesis, argued that the more profitable industries will pay higher wages because "liberal" wage policies increase workers' good will, simplify recruitment, reduce costly turnovers and create good will toward the employer in the community.[4] However, for the less profitable firms the immediate extra cost of such policies outweighs their possible longer-run advantages.[5] Therefore, he argues wage levels will be generally lower than average in the industries where managers are pessimistic about their ability to earn adequate profits in the future.

An alternative hypothesis used to "explain" inter-industry wage differential is the "competitive wage" hypothesis. This hypothesis allows for non-compensating short-run variations in wages that result from differential changes in labor demand. These changes are caused by variations in labor productivity and product-demand among industries and also by the institutional framework within which wages are customarily set. Several writers found these variables to be significant in creating short-run wage differentials.

I will now proceed to discuss the relationship between wages and several of the more important independent variables.

1. Wages and Productivity

The relationship between productivity and firms' or industries' wages has been long the cornerstone of the neoclassical theory of the firm. Other things being equal, a rise in productivity permits a proportional wage increase without altering the profit position of an industry. Thus, industries experiencing relative gains in productivity may be under short-run pressure from their workers to raise wages. It was noted that the competitive model of wage determination acknowledges the dependence of short-run variations in industry wages on the changes in the demand for labor resulting from changes in product demand as well as those caused by relative productivity changes. Yet most empirical studies found the relationship between productivity and wage changes to be rather tenuous.[6] For the United States, however, Dunlop and Garbarino obtained a statistically significant rank correlation between productivity and wage changes over the 1920-40 period.[7]

Reflecting on this contradictory evidence, Perlman argued that one would not expect a close relationship between productivity and wages if competitive conditions do not prevail in labor markets.[8] Furthermore, Perlman and others noted that an increase in productivity does not always signal an equivalent increase in the industry's ability to pay higher wages. When a reduction in unit labor costs is caused by an increase in the intensity of capital use, increases in value productivity become a misleading indicator of an industry's "ability to pay" higher wages. This is so because of the role played by prices in the process of wage determination. In one case, wages will tend to increase when the product prices of an industry are rising, even though productivity has changed very little. In another case, wages will tend to decline when an industry's productivity has increased substantially, but product prices have declined by even larger proportion.[9] Thus, in this connection it becomes important to scrutinize the role of profits in the process of wage determination.[10]

2. Profits and Wages

On the basis of the "ability-to-pay" hypothesis of wage determination, one would expect differential profits among industries to be closely related to inter-industry wages and wage changes. To quote Brown: "More profitable firms are better able to pay higher wages, and the more profitable firms of today are more likely to be the more profitable firms of tomorrow."[11]

Studies for a number of industrial countries have related wage structure and the rate of change in wages to the profitability of industries. The OECD study found that for the United States manufacturing industries: "A marked positive association appears between profitability and changes in relative earnings through the entire period from 1948."[12] Similarly a study researched for the Joint Economic Committee of the United States Congress found that within nineteen United States manufacturing industries, the two most important factors related to wage changes after 1951 were the levels of profits and the degree of competition in the product market.[13]

On the basis of these studies it seems appropriate to include a "profit" variable in my model of inter-industry wages. Unfortunately, no direct data on profitability of Brazilian industries are available. The closest I could come to approximating the industries' profitability was to obtain the non-wage component of value added for Brazil's manufacturing industries and deflate it by the value of output. Admittedly this variable includes, in addition to profits, also depreciation charges, property taxes, insurance, rent and other related items. In lieu of a "real" profit variable (e.g., the ratio of after-tax profits to industries assets) I used this proxy for the "real" profit rate.

3. Output and Employment

Changes in output may be taken as an index of the strength of demand for the industries' product. It stands to reason that industries facing expanding markets for their products will acquire a greater "ability to pay" higher wages than industries facing stable or contracting markets. In the absence of a perfectly elastic supply curve for labor, an increase in demand for the industries' product and the resulting expansion of output would result in higher wages in the expanding industries.

To some extent changes in employment among industries reflect inter-industry differences in demand for labor. In the short run the effect of these changes is to raise wages in industries that experience greater growth of output relative to the "stagnant" industries. Yet, the empirical evidence obtained for the United States does not show a consistent and significant relationship between changes in relative earnings and changes in employment.[14]

In a study of inter-industry wages in Chile, Peter Gregory found a significant association between employment and wage changes.[15] However, in Brazil increased labor earnings in some industries may have been associated with declining or stagnant levels of employment. This could occur because the industries experiencing the fastest rate of growth of output were those that absorbed unskilled labor at a slow pace compared to the "declining" industries.[16] Thus, in my regression analysis, I will attempt to test whether any significant relationship exists between changes in employment and output and changes and inter-industry wages.

4. The Ratio of Wage Cost to Value Added

The ratio of wage cost to value added has been used in the literature as an index of the importance of labor cost to an industry. It has been argued that industries, where labor costs constitute a relatively small part of total expenses, are better able to "afford" higher wages because their profit margins would not be affected in a significant way.[17] The ratio of labor cost to total cost also has a bearing on the elasticity of demand for labor. _Ceteris paribus_; the smaller the fraction of labor cost to total cost (or value added), the more inelastic will be industry's demand for labor, thus making it a prime target for unions' demands for higher wages.[18]

5. Other Relevant Variables

A number of studies have considered the industry's degree of concentration as an important cause of above average wage increases. Firms belonging to a monopolistic or oligopolistic industry can usually pass the increased costs of higher wages to the consumer in the form of higher final product prices. In addition some degree of monopoly power helps a firm to guard against possible erosion of existing profits, as a result of the entry of new firms. Furthermore, concentrated industries are very often also subject to greater union coverage or influence, leading to aggressive union demands for higher wages.[19]

Most of the studies using United States data found a significant, positive association between the degree of industries' concentration and the relative advances in workers' renumeration.[20] The concentration index for Brazilian manufacturing industries was provided to me in private correspondence by Dr. J. D. Langier. The Langier measure uses the proportion of total output provided by the 20 largest plants of each two-digit industry. Dr. Langier cautions that the concentration ratios probably provide a biased estimate of the "true" ratios, because of the multiplant operations of many firms.[21] The theoretically correct measure would be based on firms' output or sales rather than on plants data. Unfortunately, the Brazilian production statistics are not reported by firms.

Finally, several students of labor economics have advanced trade union organization as an important determinant of inter-industry wages in industrial countries.[22] In Appendix C several institutional aspects of the Brazilian labor market are discussed including the role of labor unions in wage determination. The general conclusion is that Brazilian unions were largely ineffective in obtaining higher wages and fringe benefits for their members because of their weak organizational structure, the limited scope for collective bargaining provided by law and the largely passive union membership. This elicited the following comment from W. B. Dale: ". . . the trade union (in Brazil) has been less of an influence than in other countries. In Brazil labor asserts itself more through the ballot box than through its unions."[23] Therefore, a "union strength" variable was not included in my regression model.

C. The Regression Model

Based on the foregoing theoretical considerations, I constructed an econometric model of wage determination for Brazilian manufacturing industries. Basically, two versions of the model are tested. The first formulation is based on the "ability to pay" hypothesis. The second version corresponds to the "competitive" hypothesis. The two versions use essentially the same independent variables (i.e., a measure of concentration, capital-labor ratios, percentage change in productivity and the protection variables), but the dependent variable is stated in terms of percentage changes in the "competitive" hypothesis.

1. <u>The Dependent Variable</u>

The first decision involved in the construction of the model was to choose the most appropriate measure of "wages"--the dependent variable in the regression analysis. Since the Brazilian Industrial Census does not report <u>wage rates</u> the choice was limited to the use of annual <u>earnings</u> of labor. The Census provides information both on the annual earnings of all employees and of production workers alone. Earnings data were acceptable in this study in place of wage rates because they represent the actual renumeration received by the employees and also comprise the largest proportion of the industry's variable cost. The wage earning variable used in this study include the "basic" wage and salary payments as well as certain legal or customary fringe benefits. Thus, the "wage" variable includes on-the-job earnings plus fringe benefits consisting of: end of year bonuses and gratuities, paid vacations and holidays, subsidized meals, transportation to and from work, work clothing, extra medical services, subsidized rental for employees' housing and others.[24] The use of annual earnings provides the added advantage of ironing out irregularities that may be present in data reported on a weekly or monthly basis. The independent variables used in the regressions were discussed in Part B of this chapter.

2. The Sample Data and Problems of Estimation

Using multiple regression and correlation analysis, I tested for the determinants of wages and wage changes across Brazilian industries. The relationships estimated were based on two samples. The first sample is composed of 18 two-digit manufacturing industries, and the second included 57 three-digit manufacturing industries. Both are based on the system of classifications employed by the Brazilian Industrial Census, 1960.[25] In general, the equations estimated were either in linear or log-linear form.[26] Initially both samples were tested for the determinants of the absolute levels of employees' earnings among industries. For the larger sample of three-digit manufacturing industries, I also tested for the determinants of percentage changes in labor earnings across industries.

Before stating the various forms of the regression runs, it is necessary to discuss one problem related to the estimation procedure. In principle, a model should specify as many relations as there are endogenous variables. In my regression model a strong presumption exists that one of the explanatory variables--value added per employee man-year--is endogenous. To obtain consistent estimates of the regression coefficients, I have chosen to employ lagged variables. To this end one must find a lagged variable that is uncorrelated with the regression disturbance but is correlated with the "explanatory" endogenous variable.[27] In my study the lagged value of the productivity variable was used. A similar approach was adopted in two recent studies that analyzed the behavior of wages in United States manufacturing industries.[28]

In line with the above discussion the first relationship tested can be expressed in the following linear equation:

$$(1) \quad W = a + b_1P_{-1} + b_2C + b_3Z + \varepsilon$$

where:

W = average annual earnings of employees in 18 two-digit manufacturing industries (1959)

P_{-1} = value added per employee man-year, lagged one year (1958)

C = index of concentration for each industry (percentage) (1959)

Z = the protection variables; alternatively defined as:

T = average tariff rate (percentage)

TP = average tariff rate plus exchange premiums (percentage)

ε = the error term

For each regression equation the following statistics were computed: Coefficient of multiple correlation (R), coefficient of determination adjusted for degress of freedom ($\bar{R}^2$), and the F-statistic.

In the next set of regressions the productivity variable was replaced by two measures of the industries' capital-labor intensity, alternating the gross "physical" capital per man <u>and</u> horse power per employee man-year. A "large" capital-labor ratio may imply that labor costs are a small proportion of total costs, thereby contributing to an inelastic demand for labor (see previous discussion on this point). This ratio may be also taken as an indicator of the strength of monopoly forces in the product market; i.e., high capital-labor ratio will often indicate effective barriers to entry of new firms into the industry.

$$(2) \quad W = a + b_1K^* + b_2C + b_3Z + \varepsilon$$

The added variables not defined with respect to equation (1) are:

K^* defined alternatively as:

K_1 = "gross" value of capital per employee man-year or

K_2 = horse power per employee man-year

In a few of the regression runs the proportion of wage cost in value added has been also included (the notation used is WVA).

Next I employed the extended sample of 57 three-digit manufacturing industries for 1959. With the larger sample a few additional independent variables were introduced. In the first place, the ratio of non-wage value added to industries' output was used as a measure of industries' profitability, in lieu of direct data on industries' profit rates. Secondly, more extensive use was made of the protection variable. In the extended sample, I introduced the simple averages as well as the weighted averages of industries' tariff rates. Similarly, the total protection variable was based on the weighted and simple average tariffs, of the 57 industries' products. Thus, typically the regression equation estimated was of the following form:

$$(3) \quad W = a + b_1 P_{-1} + b_2 WVA + b_3 Z + \varepsilon$$

where:

W = average annual earnings of production workers in 57 three-digit manufacturing industries (1959)

P_{-1} = value added per production worker man-year, lagged one year (1958)

WVA = wage cost divided by value added of each industry (1959)

Z = the "protection" variable that includes:

T = average unweighted tariff, levied on the industry's product

T_w = average weighted tariff levied on the industry's product

TP = total protection: average unweighted tariff plus exchange premiums

TP_w = total protection: average weighted tariff plus exchange premiums

ε = error term

In equation (4) the lagged productivity variable was replaced by a proxy for the capital-labor ratio, i.e., the horse power per employee man-year.

$$(4) \quad W = a + b_1K + b_2WVA + b_3Z + \varepsilon$$

where all variables were defined with respect to equation (3) with the exception of:

K = horse power per production worker man-year, 57 industries (1959)

In addition, based on Lary's conceptual framework, I attempted to substitute the non-wage value added per employee man-year for the industries' "stock" of capital (Notation: N_{-1}).

Lastly, in this part of the study percentage changes in inter-industry earnings (the dependent variable) were substituted for the absolute levels of these variables used heretofore. On strictly theoretical grounds there is no way to determine the "correct" functional form of these regression equations, i.e., whether the absolute values or the relative changes in the dependent variable should be employed. The rate of change in productivity as well as the previously discussed protection variables were included among the independent variables in this part of the analysis. I also tested separately for the effect of output and employment growth (percentage change from 1958 to 1959) on labor earnings. The general equation estimated was in the form:

$$(5) \quad \dot{W} = a + b_1\dot{P} + b_2K + b_3Z + \varepsilon$$

where:

$\dot{W}$ = percentage change in annual earnings of employees in 57 manufacturing industries from 1958 to 1959

$\dot{P}$ = percentage change in productivity (i.e., in value added per employee man-year from 1958 to 1959)

K = horsepower per production worker man-year (proxy for the capital-labor ratio) (1959)

Z = the protection variable; as defined previously with respect to equation (3)

D. Summary of Statistical Results and Their Economic Interpretation

The results of the regression runs are summarized in Tables 7.1A through 7.8. In spite of the imperfections inherent in this type of study and the inaccuracies in the

Brazilian data, the overall statistical results were satisfactory.

Tables 7.1A, 7.1B and 7.2A, 7.2B summarize the regression results for the sample of 18 "major" manufacturing industries. First, the computed regression coefficients for the "protection" variables were negative and statistically significant at the customary level in all of the equations tested. However, the "other" independent variables--the lagged productivity variable, the ratio of wages to value added, and the alternative formulations of the capital-labor ratio--did not perform as well as expected. In fact, the only non-protection independent variable that was statistically significant was the index of industries' concentration. Thus one can conclude that the higher the degree of monopoly in the product market the higher the industry's wages. The fact that the concentrated industries are often the most effectively unionized is one possible reason for the good showing of this variable. However, the explanation of the other disappointing results probably lies in the aggregative nature of the "major" industries' data that conceal important differences within each industry group.

This defect has been to a considerable degree rectified by running the larger sample of 57 three-digit SIC industries. In the larger sample the "protection" variable was again negative and statistically significant

TABLE 7.1A.--Cross section regression results, determinants of inter-industry labor earnings--18 major industries, 1959.

Equation Number	a	P_{-1}	C	WVA	T	
1A.1	102.65	-.0183 (.0254) [.7213]	.2539*** (.1207) [2.1029]		-.3919* (.0929) [4.2155]	R = .848 R^2= .659 F(3,14)=11.95 DW = 2.0145
1A.2	80.11	.0067 (.0382) [.1767]	+.2928*** (.1294) [2.2636]	61.9526 (69.9169) [.8861]	-.3670* (.0978) [3.7518]	R = .857 R^2= .654 F(4,13)=9.02 DW = 1.9806

(Independent Variables: P_{-1}, C, WVA, T)

Source: See Data Appendix (Appendix D).

Notes: For each independent variable the top figure is the partial regression coefficient. The figure in round parenthesis is the standard error of the regression coefficient. The figure in the square brackets is the t- statistic.

R^2 = are adjusted for degrees of freedom.

R = multiple correlation coefficient.

DW = The Durbin Watson Statistic is used as a test of the existence of significant autocorrelation in the residuals. If the calculated DW Statistic is greater than 1.70, no evidence of positive autocorrelation exists, at the one per cent level of significance. See: Carl F. Christ, Econometric Models (New York: John Wiley and Sons), p. 672, Table B-4.

* = Statistically significant at the one per cent level.

** = Statistically significant at the two per cent level.

*** = Statistically significant at the five per cent level.

† = Statistically significant at the ten per cent level.

TABLE 7.1B.--Cross section regression results, determinants of inter-industry labor earnings--18 major industries, 1959.

Equation Number	a	Independent Variables P_{-1}	C	WVA	TP	
1B.1	91.428	-.0126 (.2411) [.5229]	.1867 (.1280) [1.4589]		-.1254* (.0340) [3.6877]	R = .822 R^2= .607 F(3,14)=9.77 DW= 1.8727
1B.2	56.863	.04969 (.03394) [1.4637]	.2591† (.1320) [1.9632]	102.9758 (69.0283) [1.4918]	-.1187* (.0329) [3.6027]	R = .850 R^2= .639 F(4,13)=8.52 DW= 1.9835

Source: See Data Appendix (Appendix D)

Notes: See Notes for Table 7.1A.

TABLE 7.2A.--Cross section regression results, determinants of inter-industry labor earnings, 18 major manufacturing industries, 1959.

Equation Number	a	Independent Variables: Capital/Labor K_1	Capital/Labor K_2	C	WVA	T	
2A.1	92.85	.0091 (.0162) [.5631]		.1711 (.1011 [1.6915]		-.3268* (.0940) [3.4779]	R =.845 R^2=.654 F(3,14)=11.72 DW=1.9132
2A.2	99.85		-.5231 (.9252) [.5653]	.2027*** (.0917) [2.2118]		-.3728* (.0844) [4.4180]	R =.845 R^2=.654 F(3,14)=11.73 DW=1.8988
2A.3	65.31	.0247 (.0175) [1.4113]	.2651 (1.2165) [.2179]	.2981*** (.1189) [2.5073]	89.1384+ (50.7570) 1.7561	-.3129* (.0881) [3.3554]	R =.877 R^2=.699 F(4,13)=10.87 DW=2.3391
2A.4	80.82			.3099*** (.1412) [2.1945]	61.5080 (61.6371) [.9979]	-.3715* (.0844) [4.4022]	R =.857 R^2=.654 F(4,13)=9.03 DW=1.9988

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.1A.

TABLE 7.2B.--Cross section regression results, determinants of inter-industry labor earnings, 18 major manufacturing industries, 1959.

Equation Number	a	Independent Variables: Capital/Labor K_1	K_2	C	WVA	TP	
2B.1	87.58	.0200 (.0149) [1.3470]		.1661 (.1024) [1.6220]		-.1133* (.0334) [3.3873]	R =.841 R^2=.645 F(3,14)=11.33 DW=2.0548
2B.2	97.14		-.4644 (.9891) [.4696]	.2389*** (.0961) [2.4848]		-.1367* (.0348) [3.9264]	R =.821 R^2=.606 F(3,14)=9.717 DW=1.8874
2B.3	60.59	.0351*** (.0166) [2.1156]		.2911*** (.1213) [2.3900]	87.5748 51.7884 [1.6910]	-.1079* (.0316) [3.4158]	R =.872 R^2=.687 F(4,13)=10.34 DW=2.3344
2B.4	89.00		-.1285 (1.3855) [.0927]	.2828† (.1575) [1.7947]	24.6871 68.8156 [.3587]	-.1346* (.0364)]3.6955]	R =.823 R^2=.579 F(4,13)=6.86 DW=1.8192

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.1A.

in 14 out of 16 regression runs. Furthermore, the explanatory power of the "other" independent variables has improved. The summary of this larger sample will be found in Tables 7.3 through 7.8.

The lagged productivity and capital-labor ratio variables had the "right" signs and were for the most part significant at the five per cent or higher level. In addition, when I substituted the "flow" concept of capital--i.e., non-wage value added per production worker man-year--for the "stock" capital-labor ratio, the regression coefficient were significant at the one per cent level. Generally, the "flow" concept of capital performed better than the "stock" concept in my regressions. The other potentially important variable, wage cost in value added, was significant but it had the theoretically "wrong" sign. The implication that employers in industries where this ratio is high are better able to pay higher wages must be <u>rejected</u> on the basis of the theoretical considerations raised previously. Based on a preliminary set of runs I decided to eliminate the "profit" variable from subsequent regressions.[29] I attribute the poor showing of this variable to my inability to obtain an economically meaningful measure of the industries' profit rates. This is a serious deficiency since the "ability to pay" hypothesis employs the profit rate as an important determinant of inter-industry wages. The

TABLE 7.3.--Cross section regression results, determinants of inter-industry labor earnings, 57 three-digit manufacturing industries, 1959.

Equation Number	Number of Observa-tions	a	P_{-1}	Independent Variables: Protection Variables (Z): T	TW	TP	TPW	
3.1	57	61.101	.0894* (.0188) [4.7452]	-.1630* (.0431) [3.7807]				R =.654 R^2=.406 F(2,54)=20.21 DW=1.6684
3.2	52	60.201	.0871* (.0196) [4.4359]		-.1763* (.0594) [2.9702]			R =.665 R^2=.420 F(2,49)=19.47 DW=1.7180
3.3	57	70.093	.0804* (.0194) [4.1390]			-.0984* (.0273) [3.6078]		R =.645 R^2=.395 F(2,54)=19.32 DW=1.6050
3.4	52	71.058	.0806* (.0188) [4.2756]				-.1099* (.0284) [3.8712]	R =.704 R^2=.476 F(2,49)=24.16 DW=1.6620

Source: See Data Appendix (Appendix D).

Notes: For each independent variable the top figure is the partial regression coefficient.
The figure in round brackets is the standard error of the regression coefficient.
The figure in square brackets is the t-statistic.
The R^2 are adjusted for degrees of freedom.
DW is the Durbin-Watson Statistic and is used as a test of existence of significant autocorrelation in the residuals.
If the calculated DW Statistic is greater than 1.490, <u>no</u> evidence of positive autocorrelation exists, at the one per cent level of significance.

* = Statistically significant at the one per cent level.
** = Statistically significant at the two per cent level.
*** = Statistically significant at the five per cent level.
† = Statistically significant at the ten per cent level.

TABLE 7.4.--Cross section regression results, determinants of inter-industry labor earnings, 57 three-digit manufacturing industries, 1959.

Equation Number	Number of Observa-tions	a	Independent Variables						
			P_{-1}	WVA	Protection Variables (Z)				
					T	Tw	TP	TPw	
4.1	57	-15.594	.1727* (.0207) [8.3453]	186.5402* (30.9374) [6.0296]					R =.753 R^2=.551 F(2,54)=35.46 DW=1.6039
4.2	57	1.053	.1577* (.0216) [7.3149]	157.8946* (33.4974) [4.7136]	-.0797+ (.0459) [1.9620]				R =.772 R^2=.574 F(3,53)=26.17 DW=1.7394
4.3	52	3.698	.1524* (.0256) [5.9585]	149.0811* (42.2119) [3.5317]		-.8202 (.0597) [1.3741]			R =.746 R^2=.530 F(3,48)=20.18 DW=1.6859
4.4	57	4.897	.1541* (.0223) [6.9250]	160.3526* (32.9566) [4.8656]			-.0492+ (.0250) [1.9668]		R =.772 R^2=.574 F(3,53)=26.18 DW=1.7030
4.5	52	18.344	.1396* (.0247) [5.64227]	133.3176* (40.2326) [3.3137]				-.0693*** (.0287) [2.4174]	R =.746 R^2=.530 F(3,48)=23.04 DW=1.6778

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.3.

TABLE 7.5.--Cross section regression results, determinants of inter-industry labor earnings, 57 three-digit manufacturing industries, 1959.

Equation Number	Number of Observations	a	Independent Variables: K	WVA	Protection Variables (Z): T	TW	TP	TPW	
5.1	55	47.687	2.5311** (1.0227) [2.4627]	73.2693+ (40.2252) [1.8201]					$R=.338$ $R^2=.080$ $F(2,52)=3.[illegible]5$ $DW=1.6567$
5.2	55	71.688	1.3095† (.9784) [1.9516]	32.7385 (39.8086) [.8223]	-.1636* (.0544) [3.0084]				$R=.4[illegible]7$ $R^2=.203$ $F(3,51)=5.[illegible]0$ $DW=1.8512$
5.3	50	80.464	1.8371† (.9649) [1.9040]	11.4713 (43.8444) [.2616]		-.2474* (.0684) [3.6149]			$R=.538$ $R^2=.244$ $F(3,46)=6.[illegible]6$ $DW=2.1474$
5.4	55	78.262	2.0776*** (.9265) [2.2423]	45.9347 (36.7098) [1.2513]			-.1156* (.0308) [3.7537]		$R=.553$ $R^2=.265$ $F(3,51)=7.49$ $DW=1.8769$
5.5	50	91.019	1.8824*** (.8961) [2.1008]	15.6226 (40.5835) [.3849]				-.1478* (.0315) [4.6923]	$R=.619$ $R^2=.343$ $DW=2.0248$

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.3.

TABLE 7.6.--Cross section regression results, determinants of inter-industry labor earnings, 59 three-digit manufacturing industries, 1959.

Equation Number	Number of Observations	a	N_{-1}	WNA	Independent Variables: Protection Variables (Z) T	Tw	TP	TPW	
6.1	57	15.273	.1678* (.0298) [5.6409]	157.0707* (40.2052) [3.9067]	-.1148* (.0443) [2.5914]				R =.702 R^2=.465 F(3,53)=17.24 DW=1.7664
6.2	52	24.979	.1504* (.0337) [4.4573]	130.0407* (48.7864) [2.6655]		-.1421*** (.0632) [2.2493]			R =.675 R^2=.422 F(3,48)=13.40 DW=1.7572
6.3	57	21.696	.1612* (.0301) [5.3523]	158.7946* (39.3247) [4.0380]			-.0741* (.0268) [2.7683]		R =.708 R^2=.473 F(3,53)=17.80 DW=1.7449
6.4	52	39.108	.1400* (.0313) [4.4738]	118.7324** (44.9626) [2.6407]				-.1077* (.0290) [3.4682]	R =.720 R^2=.489 F(3,48)=17.26 DW=1.7415

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.3.
N_{-1} = Non-wage value added per production worker man-year, 1958.

TABLE 7.7.--Cross section regression results, determinants of inter-industry labor earnings, 55 three-digit manufacturing industries, 1959.

Equation Number	Number of Observations	a	P_{-1}	WVA	K	T	Tw	TP	TPw	
			Independent Variables			Protection Variable (Z)				
7.1	55	-18.748	.1670* (.0220) [7.6078]	196.3313* (32.1807) [6.1009]	.7890 (.7463) [1.0573]					R =.765 R^2=.560 F(3,51)=23.97 DW=1.6191
7.2	55	-3.1052	.1544* (.0227) [6.7882]	169.0912* (35.2798) [4.7928]	.6459 (.7367) [.8767]	-.0724† (.0418) [1.7298]				R =.780 R^2=.577 F(4,50)=19.43 DW=1.7590
7.3	50	-.4909	.1478* (.0270) [5.4782]	162.7162* (44.0579) [3.6932]	.7598 (.7808) [.9731]		-.0812 (.0606) [1.3184]			R =.757 R^2=.536 F(4,45)=15.15 DW=1.6837
7.4	55	1.5163	.1483* (.0235) [6.2994]	171.1034* (34.0758) [5.0213]	.7931 (.7278) [1.0896]			-.0485† (.0255) [1.9012]		R =.783 R^2=.582 F(4,50)=19.80 DW=1.7484
7.5	50	14.910	.1331* (.0261) [5.0945]	147.3833* (41.6737) [3.5366]	.8505 (.7493) [1.1350]				-.716*** (.0294) [2.4311]	R =.780 R^2=.574 F(4,45)=17.51 DW=1.7184

Source: See Data Appendix (Appendix D).

Notes: See Notes for Table 7.3.

TABLE 7.8.--Cross section regressions of percentage changes in labor earnings of 58 industries, 1958-59.

Equation Number	a	Independent Variables						
				Protection Variables				
		$\dot{P}$	K	T	TW	EP	EPW	
8.1	-123.668 (404.748)	-8.449† (5.098)	300.751* (102.165)					R =.370 R^2=.137 VN=1.8333
8.2	663.298 (635.067)	-7.309 (5.084)	284.344* (101.290)	-10.996† (6.901)				R =.419 R^2=.175 VN=1.830
8.3	561.200 (538.418)	-8.492 (4.985)	321.948* (100.539)		-11.704 (6.238)			R =.435 R^2=.189 VN=1.8283
8.4	1229.796 (716.147)	-7.440 (4.941)	288.350* (98.725)			-6.939** (3.078)		R =.459 R^2=.211 VN=1.7771
8.5	860.848 (586.490)	-8.703† (4.921)	328.439* (99.353)				-6.094** (2.708)	R =.459 R^2=.210 VN=1.7411

Source: See Data Appendix (Appendix D).

Notes: For definitions of the protection variables see the Notes for Table 7.3.

For each independent variable the top figure is the partial regression coefficient; the figure in parenthesis is the standard error of the regression coefficients.

R^2 is adjusted for degrees of freedom.

VN is the Von Neumann ration, which is used as a test of the existence of significant autocorrelation in the residuals.

If the calculated Von Neumann ratio falls between 1.4294 and 2.6407, no evidence of autocorrelation is present at one per cent level of significance.

* = Statistically significant at the one per cent level.

** = Statistically significant at the five per cent level.

† = Statistically significant at the ten per cent level.

substitute I used for want of an industry's profit rate--the ratio of non-wage value added in gross output--showed no significant relationship to earnings changes.

The final sets of regressions (summarized in Table 7.8) uses the percentage change in the wage and productivity variables. It therefore corresponds to the "competitive" wage determination hypothesis. The results were considerably less satisfactory than the previous set of runs. Yet once again the protection variable had a negative sign and was significant in three out of four cases. By running a regression of the percentage change in labor earnings against employment or output changes, I found these variables not to be significantly correlated.[30]

The most significant conclusion from my empirical work is that tariffs and total protection had an important effect on the earnings of industrial labor in Brazil. It also appears that the negative ("perverse") effect of protection on inter-industry wages is the same regardless of whether unweighted or weighted tariffs were used in the regressions. The numerical "size" of the regression coefficients is small; thus a "moderate" increase in tariffs or total protection will have a relatively small impact on labor earnings.

Yet the direction is unmistakable in all of my regression runs. My results show that the Brazilian Tariff did in fact harm Brazil's industrial labor force. These findings are in accord with what would be expected from the Stolper-Samuelson theorem. Namely, the country's scarcest factor would indeed benefit if the tariff was structured to effectively protect the scarce factor, or rather the industries using the scarce factor relatively intensively. Thus a country that has a shortage of skilled labor could increase the earnings of that factor, but only if the tariff actually protected the scarce factor. In that sense the "orthodox" results have been confirmed in this study. There is no presumption that the Metzler case indeed applies to the Brazilian situation.

This study is not able to determine the effect of profits on wage rate changes. This indicates the need for better profit information on Brazilian industries. If the omitted variable, i.e., profit rate, is related to some of the independent variables included in the regressions--such as the capital-labor ratio--a specification bias may have been introduced into our estimates of the regression coefficients. Namely, one would be attributing to the variables that have been included, some of the influence due to the omitted variable, the profit rate.[31] Thus, if I were able to introduce an adequate profit variable, my estimates would have gained in precision and reliability.

As it stands, the foregoing analysis has enabled me to build a model of wage determination for Brazilian manufacturing industries. I have established the direction and approximate magnitude of the protection variables' effect on the earnings of industrial labor. If it had been possible to obtain a satisfactory profit variable, I believe that the model's explanatory power would have been enhanced considerably.

FOOTNOTES: CHAPTER VII

[1]This results from the operation of the law of diminishing returns and the assumption of profit maximization. In the so-called stage-II where the cost minimizing firm is likely to operate, both the average and the marginal product of labor will be falling. If the relevant production is of the Cobb-Douglas type--with neutral technological change, the average and marginal product will differ only by a multiplicative constant.

For detailed discussion see for example: R. H. Leftwich, The Price System and Resource Allocation (4th ed.; Hinsdale, Ill.: The Dryden Press, 1970), pp. 117-123.

[2]In my study I calculated only the value productivity measure for each industry. In addition to the conceptual difficulties noted in employing a measure of physical productivity, in the case of Brazil, price deflators by industry are not available. Certainly it does not make any economic sense to use a single deflator, like the wholesale price index for all manufacturing industries, when we are studying the interindustry structure of wages.

[3]Excellent review of these findings to which references will be made throughout this chapter is found in: OECD, Wages and Labour Mobility (Paris: July, 1965).

[4]David G. Brown, "Expected Ability to Pay and Interindustry Wage Structure in Manufacturing," Industrial and Labor Relations Review, XVI (October, 1962), 45.

[5]In this connection Brown remarked: "In the less profitable firms teetering at the brink of extinction, managers are more concerned with preserving the firm than with easing their jobs and gaining community prestige; employees are more concerned about unemployment than under-payment."

Ibid., 46.

[6]The OECD study states: "The data examined by us indicate no significant tendency for above average productivity gains to be associated with more rapid earnings increase, although due weight must be given to the possibility that the apparent absence of any relationship may be accounted for by the very great difficulties of measuring changes in productivity adequately."

OECD, op. cit., pp. 110-12.

Several other studies based on United States manufacturing data arrived essentially at the same conclusion.

The following studies found no significant relationship between wage and productivity changes:

Harold M. Levinson,"Postwar Movement of Prices and Wages in Manufacturing Industries," Study Paper No. 21, Joint Economic Committee, Congress of the United States, January 30, 1969, also:

D. M. Eisemann, "Interindustry Wage Changes 1939-47," Review of Economics and Statistics, XXXVIII (November, 1956), also:

D. G. Brown, op. cit., 51-52, Table 1., also:

F. Myers and R. L. Bowlby, "The Interindustry Wage Structure and Productivity," Industrial and Labor Relations Review, VII (October, 1953), also:

Donald R. Snodgras, "Wage Changes in 24 Manufacturing Industries, 1948-59; A Comparative Analysis," Yale Economic Essays, III (Spring, 1963), 171-222.

[7]Dunlop suggested that the highest productivity gains are to be expected early in an industry's life when output is expanding rapidly. He attributes the above average wage increases not only to the industry's "ability to pay," but also to its need to attract additional work force.

John Dunlop, "Productivity and the Wage Structure," Income, Employment and Public Policy: Essays in Honor of Alvin H. Hansen (New York: W. W. Norton, 1948), pp. 341-62.

Also see: Joseph W. Garbarino, "A Theory of Interindustry Wage Structure Variation," Quarterly Journal of Economics, LXIV (May, 1950), 282-305.

[8]Richard Perlman, "Value Productivity and the Interindustry Wage Structure," Industrial and Labor Relations Review, X (October, 1956), 26-39.

[9]The relationship between wage, price and physical productivity change has been examined by Clark Kerr. Kerr found several instances during the recent decades when wages, under the influences of price changes, seemed to move independently of productivity changes. It is conceivable that productivity increases in one industry may

lead to relative price declines rather than to higher wages; while another industry, experiencing favorable demand for its product and consequently, increases in prices and profits, may raise wages without a comparable productivity change.

Clark Kerr, "The Short Run Behavior of Physical Productivity and Average Hourly Earnings," Review of Economics and Statistics, XXXI (November, 1949), 299-309.

Perlman found Rank correlation coefficient of .68 and .58 between sales per man-hour and average hourly earnings in 20 United States manufacturing industries for the periods 1939-47 and 1947-53 respectively. See: Perlman, op. cit., 35.

[10]The neoclassical theory of the firm tells us that a firm will use the combination of resources that equates the marginal physical product per dollar's worth of each and every variable factor used. To maximize profits the firm will produce the level of output that will equate its marginal cost to the product price (or marginal revenue). See: Leftwich, op. cit., pp. 282-85.

[11]Brown, op. cit, 47.

[12]OECD, op. cit., p. 105.

[13]Levinson, op. cit., pp. 3-6, Tables 1, 2 and 3. In another study Bowen found that for six subperiods between January, 1947 and June, 1959 profits showed a more consistent relationship with wage changes than employment, concentration or labor market organization. For details see: W. G. Bowen, "Interindustry Variations in the Unemployment Wage Relationship," Wage Behavior in the Postwar Period: An Empirical Analysis (Princeton, N. J.: Princeton University, 1960).

[14]See for example: Melvin Reder, "Wage Differentials: Theory and Measurement," Aspects of Labor Economics, National Bureau for Economic Research Conference, Princeton, N. J., 1960 (Princeton, N. J.: Princeton University Press, 1962), p. 278.

[15]Gregory did find a positive association between productivity and wage changes. See: Peter Gregory, Industrial Wages in Chile (Ithaca, N. Y.: Cornell University, 1967), Chapter V.

[16]I am referring here to the evidence that was compiled by Baer and Kerstenetzky with respect to the distribution of gross value added and employment of labor in Brazil's industry. It was observed that between 1950

and 1960 the share in value added of the "traditional" industries, i.e., textile, food products, clothing and wool, has declined. On the other hand, the share of the industries that were most affected by import substitution, e.g., transport equipment, electrical machinery, chemicals and metal products, have risen impressively. While the "traditional" industries were characterized by less than proportional fall in employment compared to gross value added; the "dynamic" industries saw a greater expansion of gross value added relative to changes in employment.

For further details see: W. Baer and I. Kerstenetzky, "Import Substitution and Industrialization in Brazil," American Economic Assocation Papers and Proceedings, LIV (May, 1964), 418, Table 4.

[17]Presumably this assumes that the firms are unable to pass on the increased labor cost to the consumer in the form of higher prices. See: Brown, *op. cit.*, 48.

[18]This argument was originally advanced by Marshall and later adopted by Friedman. See: Milton Friedman, Price Theory, A Provisional Test (Chicago: Aldine Publishing Company, 1962), pp. 155-56.

[19]See: Martin Segal, "The Relation between Union Wage Impact and Market Structure," Quarterly Journal of Economics, LXXVIII (February, 1964), 96-114.

[20]Garbarino found the Rank correlation coefficient between the degree of concentration and changes in earning to be .67 and rising to .75 with the elimination of the coke industry. See: Garbarino, *op. cit.*, 299-302.

D. G. Brown found the partial correlation coefficient between wages and concentration to be .326. See: Brown, *op. cit.*, 53-54.

However, conflicting results were obtained when the relationship between concentration and wages was tested for other industrial countries. In the United Kingdom the relationship is of limited practical significance, while for Germany an opposite tendency has been observed, i.e., the less concentrated industries experienced larger earning gains. See: OECD, *op. cit.*, p. 115.

[21]The calculations by Langier were based on Bain's method, outlined in: Joe S. Bain, International Comparison of Industrial Structure (New Haven, Conn.: Yale University Press, 1966), pp. 27-29.

[22]Garbarino considered increased profits and concentration of an industry as providing permissive conditions for wage increases. The oligopolistic market structure may protect the cost decreases and profit increases from the inroads of competition, making them potentially available to wage earners. The compulsion may be in the form of aggressive trade unions which exert upward pressure on wages in the light of "excessive" profits or visible increases in labor productivity. Peter Gregory acknowledged the possibility of unions having a considerable effect on the earnings level of industrial labor force in Chile. He noted that a monopolistic market structure, accompanied by other conditions that give rise to inelastic demand for labor, will enhance the bargaining power of labor unions. This could lead to higher wages in the affected industries. See: Garbarino, op. cit., 299-302.

For an analytical treatment of this topic also see: Segal, op. cit., 96-104, also see: Gregory, op. cit., p. 69.

[23]Dale, op. cit., p. 60. The role of trade unions may have been on the ascent during the Goulard era of the early 1960's. During his administration, trade unions received generous government support and some encouragement in pursuit of higher wages. See: Gregory, op. cit.

[24]Details on the non-wage component of labor earnings are found in: Dale, op. cit., pp. 62-66.

[25]Data on the characteristics of industrial activity and labor earnings were obtained from the 1960 Industrial Census that covers the year 1959. See: IBGE, Serviço Nacional de Recenseamento, Censo Industrial de 1960, VII Recenseamento Geral do Brasil.

The corresponding data for 1958 were obtained from: IBGE, Conselho Nacional de Estatistica, Produção Industrial Brasiliera, 1958, Rio de Janeiro, December, 1960.

[26]There is no a priori way to determine (based on economic theory) the correct functional form, i.e., linear or logarithmic. Use of the arithmetic form presumes that there is a relation between the absolute differences in the dependent and independent variables, from industry to industry; while use of the logarithmic form assumes that there is a relation between the percentage differences from industry to industry in the relevant variables.

[27] For a theoretical discussion of the use of lagged variables consult: J. Johnston, Econometric Methods (New York: McGraw-Hill, 1963), pp. 165-66.

See also: J. D. Sargan, "The Estimation of Economic Relationships Using Instrumental Variables," Econometrica, XXVI (July, 1958), 393-415.

[28] For details consult: E. Kuh, "A Productivity Theory of Wage Levels--An Alternative to the Phillips Curve," The Review of Economic Studies, XXXIV (October, 1967), 333-360.

Also see: R. D. Rippe, "Wages, Prices, and Imports in the American Steel Industry," Review of Economics and Statistics, LII (February, 1970), especially 34-38.

[29] The regression of wages on the "profit" variable gave the following results:

$$W = \underset{(14.547)}{63.357} + \underset{(40.374)}{25.197}P$$

$$R = .0831$$
$$R^2 = .0069$$
$$V_N = 1.4946$$

Where: W = average annual earnings of production workers in 58 industries.
P = "profit" variable, i.e., non-wage value added divided by industries' gross output.

[30] The regressions of percentage changes of wages on output and employment changes (1958-59):

(a) $$\dot{W} = \underset{(340.258)}{324.589} - \underset{(1.506)}{.005}\dot{Q}$$

$$R = .0004$$
$$R^2 = .0000$$

(b) $$\dot{W} = \underset{(317.893)}{214.157} + \underset{(1.345)}{1.248}\dot{E}$$

$$R = .1275$$
$$R^2 = .0163$$

Where: $\dot{W}$ = percentage change in annual earnings of all employees in 58 manufacturing industries.
$\dot{Q}$ = percentage change of gross output 1958-59.
$\dot{E}$ = percentage change in total employment 1958-59.

[31] For a full discussion of the effect of a specification error on least square estimates see: E. Malinvaud, Statistical Methods of Econometrics, trans. by A. Silvey (Chicago: Rand-McNally, 1966), pp. 263-66.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The first part of this study examined the structure of Brazil's foreign trade with respect to the availability of capital and skilled labor, the country's most scarce resources. It has been established that Brazil is well supplied in "nature," a combination of natural resources (such as soil, climate, forestry and deposits of certain ores) and unskilled labor. "Nature" and unskilled labor complement each other in the production of coffee, cocoa, cotton, sugar, tobacco and iron ore and give Brazil her "revealed" comparative advantage in the exports of these commodities.

Brazil suffers from an acute shortage of skilled labor at all levels, but most seriously at the highest level, i.e., engineers, technicians, managers and competent administrators. Thus, the country imports skill intensive commodities from North America and Western Europe to alleviate her skill shortage. This "explains" why over 80 per cent of Brazil's imports of manufactured goods (SITC 5, 6, 7 and 8) come from the skill abundant countries; thus the "neofactor" proportions hypothesis, based on relative availability of human capital between Brazil and her trading partners, has been substantiated in this study.

"Physical" capital did not perform as well as human capital availability in explaining Brazil's trade patterns. Furthermore, using Lary's single measure of industries' "overall" factor intensity, I attempted to test whether a combined index of "physical" and human capital could account for Brazil's trade patterns. The results of these tests were inconclusive and it is conceivable that a different measure of "overall" factor intensity may provide a more satisfactory test of this hypothesis.

Brazil's exports of manufactures presented a special problem because when examined in relation to the forementioned versions of the factor proportions theorem, they did not show any clear-cut pattern. Based on a priori reasoning one would expect Brazil to export considerable amounts of simple, unskilled labor intensive commodities. Yet in 1965, Brazil exported only about $120 million worth of SITC 5, 6, 7 and 8 goods; of which only about 40 per cent were destined to industrial countries. For instance, Brazil's share of less developed countries' exports of manufactured goods into developed countries was less than <u>one</u> per cent (.6 per cent to be exact).[1] This is an undistinguished record for a country that built a substantial industrial base in the period after World War I and whose industrialization experienced a "take off" in the post World War II period.[2]

Thus, it was important to investigate why Brazil's exports of manufactures did not reflect her factor availabilities. Largely through import substitution, manufactures exports came artificially to complement her domestic industrialization program. Therefore, the irrationalities and inefficiencies imparted to Brazil's production structure by past import substitution policies inhibited the exports of her manufactured goods. The most blatant example of this is the Brazilian textile industry. One of the earlist industries in Latin America, it is still not making a significant contribution to Brazil's export earnings (for details see Appendix A).

It is widely recognized that Latin American countries "need" to move from an import substitution-based growth into an exports-oriented growth based on manufactures rather than primary commodities. My analysis indicates that there is little likelihood for Brazil becoming an important exporter of even simple manufactured goods.

To bring the study up to date, I would like to report on the recent policies initiated by Brazil that may have important long-run implications for her exports and imports. I am referring to two measures of import liberalization carried out by the Brazilian government between 1965 and 1967. From November, 1966 to March, 1967 two major steps were undertaken. One was a thorough revision and general reduction in the level of tariffs, and the second was a complete elimination of the remaining exchange premiums. Furthermore, the "basic" exchange rate has been devalued several times between 1964 and 1969 to "keep up" with the rapid rate of domestic price increase.

This move toward import liberalization constitutes a significant departure from past Brazilian trade policies. In the past the policy has been to provide whatever degree of protection necessary for uninterrupted import substitution. The new policy should provide increased competition from imports and thus should encourage improved efficiency and lower cost of production in Brazilian manufacturing industries. This combined with a "continuous" devaluation of the cruzeiro may provide Brazilian firms with a profitable opportunity to expand exports rather than continuing, as in the past, to treat export sales as incidental compared to their domestic business.[3]

The second part of the study dealt with the impact of Brazil's structure of protection on the earnings of her industrial labor force. It drew on some characteristics of Brazil's foreign trade established in the first part. The point of departure for the second part of the study was the previously established proposition that human capital is Brazil's most scarce factor of production. Thus, for the scarce factor to benefit from a change in tariff, those industries using human capital intensively should receive the highest protection; because then the tariff (assuming that there is no change in the country's terms of trade) will tend to raise industrial labor's wages both absolutely and relatively.

On the basis of the analysis contained in Appendix A, I concluded that Brazil probably faces an elastic demand for her exports. Therefore one would expect that a correctly structured tariff would raise the earnings of the country's industrial labor force. This proposition was subjected to an empirical test in the last chapter by constructing a wage determination model. The major conclusion derived from the model was that in Brazil's case the tariff and total protection had a negative effect on the earnings of skilled industrial labor.

As was stated in the conclusion to Chapter VII, these results are in agreement with the Stolper-Samuelson theorem and its major implication that import duties can raise the wage of the scarce factor. But in order for the Brazilian Tariff to have the "normal" protective effect it will have to be restructured so as to accord high protection to those industries that use the country's scarce factor relatively intensively.

FOOTNOTES: CHAPTER VIII

[1]The statistics for Brazil's exports are included in Data Appendix. For the data on less developed countries' trade see: Lary, op. cit., p. 96, Table 10.

[2]For details consult: Baer, op. cit., Chapters 2 and 6.

[3]Further details can be found in: Paul G. Clark, "Brazilian Import Liberalization," Research Memorandum No. 14, Center for Development Economics, Williams College, Williamstown, Mass., September, 1967. (Mimeographed.)

APPENDIX A

A DETAILED ANALYSIS OF BRAZIL'S EXPORTS AND IMPORTS

A. Brazil's Commodity Exports

Currently as in the past a relatively small number of primary commodities dominate Brazil's exports. Coffee, cocoa, cotton, sugar, tobacco and more recently iron ore are central to the country's earnings from exports. The growth rate of world trade in many of these commodities was highly unfavorable, thus seriously limiting Brazil's export-based capacity to import.[1] A more detailed analysis of Brazil's exports follows.

1. Coffee Exports

Brazil has traditionally been an important exporter of a few primary commodities. For decades it has been the world's largest coffee producer and exporter. During the 1920's coffee usually represented 60 to 70 per cent of the country's exports. In the great depression, world demand for coffee declined markedly and coffee prices fell sharply. After the Korean War coffee prices rose distinctly, reaching their peak in 1954. But since the mid-1950's coffee prices were declining once more, rebounding to some degree in 1964-65.[2]

In the postwar period coffee became increasingly important in the exports of certain African countries. These countries increased their share of the world market in coffee from 7 to 8 per cent in the 1930's to about 25 per cent in the early 1960's.[3] Production of and trade in the Robusta type of coffee, mainly from African sources, more than doubled between the early 1950's and the early 1960's.[4] This growth took place mainly at the expense of Brazil, whose share of world coffee exports fell from about 53 per cent in the 1934-38 period to about 38 per cent during the 1962-63 period.[5]

Despite these developments coffee exports are still the single most important source of the country's foreign exchange earnings. During the 1964-65 period the value of Brazil's coffee exports was about 48 per cent of all commodity exports, by far the largest item in its export bill. Since about 87 per cent of Brazil's coffee exports during this period went to industrial countries the future prospects of coffee exports depend largely on the growth of coffee consumption in North America and Western Europe. Rex F. Daly estimated for the United States the effects of changes in incomes and prices on consumption of coffee, for the period 1922-41. Daly's empirical results show a low income elasticity of demand for coffee

(.23) and a price elasticity of demand of only (-.26), over the period of investigation.[6] Daly found the price elasticity of demand for coffee to be stable over time. When estimated for the postwar 1947-57 years it was about (-.25).

Balassa assumed the income elasticity of demand for coffee to be (.20) and by taking into account recent trends in coffee drinking habits he estimated that between 1960 and 1975 per capita coffee consumption in the United States would rise only 12 per cent.[7] According to Balassa's projections, coffee imports of all industrial countries would rise by 34 or 37 per cent between 1960 and 1970.[8] These estimates appear to me somewhat optimistic given the experience of the 1950's. Most significantly, Cohen's data indicate that coffee imports by the United States, Canada and Western Europe have <u>declined</u> by 12 per cent between 1952-54 and 1962-64.[9]

It is of interest to compare Daly's and Balassa's estimates with those employed by the FAO in its projections of world coffee consumption (see Table A.1). Based on these studies it is evident that Brazil's coffee exports face a price inelastic world demand. This is collaborated by the government's domestic coffee policy that is a reflection of the tacit acceptance of the notion of the inelasticity of world demand for Brazil's coffee.

TABLE A.1.--Price and income elasticities of coffee demand and actual and projected coffee consumption (thousand tons).

Country or area	(1) Income elasticity	(2) Price elasticity	(3) 1963 projected coffee consumption (#)	(4) 1962-64 actual coffee consumption	(5) "Residual" $\frac{(4)-(3)}{(4)} \times 100$
North America	.3	-.1	1491	1431	-4.2
EEC	.6	-.2	680	707	+3.8
Other Western Europe	.5	-.3	296	335	+11.6
Total Western Europe	n.a.	-.24	1031	1192	+13.5
All industr. countries	n.a.	-.18	2717	2709	-.3

Source: Food and Agricultural Organization, Agricultural Commodities--Projection for 1975 and 1985 (Rome: United Nations, 1967), p. 51, Table I.

Notes: (#) Projection adjusted for price changes.

The government policy was to purchase coffee from planters and store it in years when the world market would not absorb Brazilian coffee exports at the "desired" price. This effort reflected the dominant supplier position of Brazil in the international coffee market.[10] Leff noted that the coffee market could be described by an "open" oligopoly model, which would explain the policy of high prices and the steady loss of Brazil's market share to its competitors.[11]

Next I will discuss at some length the available estimates of the elasticity of demand as regards Brazil's non-coffee primary exports.

2. Cocoa, Cotton and Other "Minor" Primary Commodity Exports

The analysis of world demand for Brazil's coffee exports can apply, with some qualifications, to its cocoa exports. The major difference is that Brazil is not a dominant supplier of cocoa in the world market. In 1960 Ghana and Nigeria together accounted for 50 per cent of world exports, while other African producers supplied another 20 per cent. Brazil's share of the world market in cocoa has been on the decline in recent years. During the period between 1948 and 1952 Brazil supplied about 14 per cent of total world exports, but its share fell to about 10 per cent in 1961.[12] Over the postwar years cocoa declined in importance in Brazil's total commodity exports. During 1945-49 cocoa exports averaged 4.3 per cent of the total value of exports; in 1964-67 its share fell to 3.7 per cent.[13] The main markets for Brazilian cocoa beans are the industrial countries. The largest single buyer is the United States that together with Canada accounted for about 46 per cent of Brazil's cocoa exports. In all, about 70 per cent of Brazil's cocoa exports during the 1964-65 period were marketed in industrial countries.[14]

Cocoa may be faced with even less "favorable" world demand conditions than coffee. Balassa in his projection of world cocoa consumption used the income elasticity of .35 for the United States, .40 for Western Europe and .50 for most other European countries.[15] Both the Balassa and the FAO studies found the price elasticity of demand of cocoa to be considerably smaller than <u>one</u>.[16] J. Richard Behrman obtained two sets of estimates of demand elasticities of cocoa in the major consuming countries.[17] His major findings are reproduced in Table A.2. His estimates suggest that for the United States and the United Kingdom cocoa is an <u>inferior</u> good. It may be that with higher per capita incomes there is a tendency for cocoa to become an inferior good. This obviously would put the long run trend for world cocoa exports in a very unfavorable position. Thus, the almost continuous decline in the quantity of

TABLE A.2.--Elasticity estimates of the demand for cocoa, 1950-61.(1)

Country	Instrumental variable estimates: Income elasticity	Price elasticity	Cross-price elasticity with sugar	R^2	Ordinary least squares: Income elasticity	Price elasticity	Cross-price elasticity with sugar	R^2
France	.53†	-.4**	-.84†	.54	.22†	-.01†	.99**	.41
West Germany	.81*	.02	-.05	.91	.77*	-.05	.03	.91
Netherlands	-.14†	-.18	.44	.60	.13†	.17†	.59	.50
United Kingdom	-.35*	-.01***	.66***	.82	-.35*	-.01	.50†	.76
United States	-1.58***	-.11**	-.49	.73	-1.97*	-.40*	-.23†	.93

Source: J. Richard Behrman, "Cocoa: A Study of Demand Elasticities in the Five Leading Consuming Countries, 1950-1961," Journal of Farm Economics, LXVII (May, 1965), 416, Table 1.

Notes:
- * Significant at the .0005 level.
- ** Significant at the .05 level.
- *** Significant at the .10 level.
- † Significant at the .25 level.
- (1) Of the 1961 total Brazilian cocoa exports, the United States, West Germany and the Netherlands absorbed about 64 per cent (in volume). Calculated from: Survey of the Brazilian Economy--1965 (Washington, D. C.: Brazilian Embassy, 1966), p. 69, Table XXVIII.

Brazil's cocoa exports since the mid-1950's may be a reflection of that trend.

Cotton has traditionally been Brazil's second most important commodity export. During the 1964-65 period the earnings from cotton exports (SITC 263) were about $105 million a year, while exports of textile fibers as a whole (SITC 26) were about $158 million. Cotton and textile fibers accounted for 6.9 and 10.4 per cent, respectively, of all Brazilian exports in 1964-65.[18]

Balassa estimated the income elasticity of demand for textile fibers in North America at .53 and that of Western Europe between .60 and .70.[19] The United States demand for cotton was estimated by Donald, Lowenstein and Simon.[20] Their results suggest a low price elasticity of demand (-.14) and a low income elasticity of demand (.42) for cotton. In addition, they found that a one per cent increase in per capita non-cellulosic fiber consumption would result in a .14 per cent reduction in per capita cotton consumption.[21]

During 1964-65 Western Europe was the destination of about 65 per cent of all Brazilian exports of textile fibers; Eastern Europe and Japan purchased about 8 per cent each. The future expansion of Brazil's exports of natural fibers depends on the expansion of textile manufacturing in Western Europe and Japan and on the extent of substitution of synthetics for natural fibers in the industrial countries. The FAO projections do not chart a very favorable future course for Brazil and other exporters of textile fibers. At 1961-63 prices, the volume of world demand for cotton imports in 1975 is projected to be 15 to 20 per cent lower than in 1961-65. Net import requirements in 1975 are projected to be 20 per cent lower in Western Europe and 35 per cent lower in other developed countries.[22]

Sugar (SITC 061) and tobacco (SITC 121) are two primary commodities whose share in total exports have been essentially unchanged over the last decade. During 1964-67 exports of sugar were about $64 million annually and that of tobacco about $25 million annually. In 1957-59 sugar constituted 3.7 per cent of all exports and tobacco about 1.2 per cent, while during the 1964-67 period the two commodities' share of total exports was 3.9 and 1.5 per cent, respectively. Once more the main markets for both of these commodities were found in the industrial countries. The largest share of Brazilian sugar exports in 1964-65 was directed to the United States (59 per cent), Western Europe being the main secondary market (16 per cent). Regarding tobacco the situation was reversed; Western Europe being the main market (with 73 per cent) and the United States being a distant second (11 per cent).

Both the FAO and the Balassa studies forecast only a very small expansion of sugar imports in the industrial countries in the near future.[23] The exports of tobacco face somewhat more favorable prospects in the coming years. In fact, Brazilian exports of tobacco increased from an average of 45,000 tons in 1961-63 to about 57,600 tons in 1964-65, an increase of about 28 per cent.[24] The future prospect of exports into Western Europe seems especially favorable.[25]

The limited number of empirical studies available all indicate the demand for tobacco and/or cigarettes to be price inelastic. Sachrin estimated the price elasticity of demand for cigarettes in the United States to be between -.3 and -.4; and the income elasticity of demand to be about .50.[26]

Anna P. Koutsoyannis set out to estimate the demand function for <u>tobacco</u> of 14 industrial countries. The price elasticity of demand she obtained varied from the high of -.951 (for Austria) to the low of -.147 (for Ireland); while the income elasticity of demand varied from the high of .828 (for France) to the low of .115 (for Austria).[27] All the coefficients of price elasticity were negative, and in no country did tobacco turn out to be an "inferior" good. Thus, if there will be some upward movement in tobacco prices, as projected by the FAO, Brazil and other exporting countries can expect an increase in their foreign exchange receipts from tobacco.

There are a few other primary commodities of which considerably smaller quantities were exported in the mid-1960's. Their average annual exports in 1964-65 were: hides and skins (SITC 21), about \$15 million; rubber (SITC 231) about \$6 million; and forest products (SITC 242 and 243) about \$59 million.[28]

Lastly, we turn to the export of iron ore, which has been growing rapidly in recent years, and soon may replace cotton as Brazil's second most important commodity export. Exports of iron ore (SITC 281) averaged \$92 million during 1964-65 and \$102 million in 1966-67. In 1966-67 about 43 per cent of Brazil's iron ore exports were directed to the EEC, about 21 per cent to North America and about 14 per cent to Japan. Cohen's study found that the imports of iron ore by North America and Western Europe grew at the annual rate of 8 per cent between 1952-54 and 1962-64. This compares favorably to the growth rate of imports of all primary commodities (3.3 per cent) and even of all commodities (6.9 per cent) during the same period.[29] Future prospects appear quite favorable. Balassa projected that the iron ore exports of underdeveloped countries will rise by 75 or 100 per cent between 1960 and 1970; and 140 or 180 per cent between 1960 and 1975.[30] In fact, between 1961 and 1967 the volume of Brazil's iron ore exports increased by about 128 per cent.[31] Given Brazil's very large reserves of iron ore, second only to the Soviet Union, and the deliberate policy of the government to increase production for exports, the future prospects look favorable indeed.

3. Exports of Manufactured Goods

Exports of manufactured goods (SITC 5, 6, 7 and 8) grew rapidly during the 1960's. For example, in 1962 they were about $37 million, rising to $124 million in 1965; thereby registering a 330 per cent increase over this period. The main markets for Brazil's manufacturing exports in 1964-67 were: Latin America with about 48 per cent, North America with about 28 per cent and Western Europe with about 13 per cent. In all, during this period industrial countries accounted for about 46 per cent of Brazil's manufactures exports.[32] The preferential treatment accorded Brazilian industrial products under the Treaty of Montevideo largely accounted for the growth of manufacturing exports into LAFTA countries.[33]

I divided the overall exports of manufactures into those of the "traditional" industries and those of the "dynamic" or modern industries. The exports of the "traditional" manufacturing industries, many of them using cheap domestic raw materials, were largely directed toward the markets of the industrial countries. About two-thirds of the exports of leather and footwear (SITC 61) were sold in the United States, with the share of all industrial countries being about 76 per cent. The largest importers of veneer, plywood and other wood products (SITC 631 and 632) were Western Europe (47 per cent) and North America (38 per cent).[34]

Textile yarn and cotton fabrics (SITC 651, 652 and 655) exports averaged about $7 million during 1964-65, and almost $10 million during 1966-67. The largest single market for these products during 1964-67 was the United States (with 79 per cent); Western Europe (about 10 per cent) was considerably less important. Brazil's textile industry is one of the earliest in Latin America and the country has largely achieved self sufficiency in textiles and wool products and certain man-made fibers. Yet the country was unable to become a significant exporter of cotton textiles. Let us take the United States market as a special case. In 1965 the United States imported $409 million worth of textiles (SITC 651) from the less developed countries; the share of Brazil of this total was $8.5 million or only about two per cent.[35]

Among the "dynamic" industries, the case of chemicals stands out because it is the only modern industry whose exports were largely directed toward industrial countries. In 1964-65 exports of chemicals (SITC 5) were about $16 million a year, rising to about $28 million a year in 1966-67.[36] The main markets for Brazil's chemicals were the United States (48 per cent), Western Europe (23 per cent) and Latin America (13 per cent). ECLA provided an estimate of the average 1959 prices of an extensive group of chemicals produced by six Latin American countries.[37] Among the six LAFTA countries, only the prices of Brazil's chemicals were found to be lower than comparable prices in the United States. This puts Brazil in a favorable position for future expansion of exports of chemicals, within LAFTA and in third country markets.

The steel industry in Brazil was established as early as 1925, but the major expansion of productive capacity came with the creation of the Volta Redonda Plant in 1946.[38] During 1964-66 Brazil's production of steel ingots averaged about 3 1/4 million tons, with a planned expansion of capacity by about one million tons in the near future.[39] Exports of iron and steel (SITC 67) during the 1964-67 period averaged about $32 million with the bulk of it going to Latin America (60 per cent) and about 37 per cent going to all industrial countries. Despite the considerable headway made through import substitution in this sector, Brazil was still a net importer of steel in 1964-67.[40] However, given the locally available supply of high grade iron ore and a large and expanding domestic capacity, the chances for expanding exports, especially into LAFTA countries, appear quite favorable.

Exports of "basic" manufactures (SITC 6) as a whole expanded rapidly. In 1954-55 these exports averaged \$8.2 million, rising to \$58 million in 1964-65 and finally reaching \$73 million in 1966-67. Over the 1964-67 period about 46 per cent of exports in this category were sold in Latin America, with about 49 per cent going to industrial countries.

In the category of machinery and transport equipment (SITC 7) two items stand out--exports of non-electric machinery (SITC 71) that averaged about \$19 million in 1964-67, and exports of transportation equipment (SITC 73) that averaged about \$7.2 million. In the case of both of these goods, between two-thirds and three-fourths of exports were directed to Brazil's Latin American neighbors. In 1964 exports of motor vehicles were about \$2.0 million, rising to about \$4.5 million in 1966.[41] While these figures in themselves are not impressive, it must be born in mind that the Brazilian automotive industry came into existence in 1957.[42] In 1957 only about 30,700 motor vehicles (mainly trucks and jeeps) were produced; ten years hence, in 1966, 225,000 units were produced. Given that Brazil is the lowest cost producer of motor vehicles in South America, it is possible that her exports of automotive vehicles to other LAFTA countries will expand beyond the \$4.2 million achieved in 1966.[43]

In the category of machine and transport equipment as a whole (SITC 7), about 75 per cent of Brazil's exports in 1964-67 went to Latin America with about 20 per cent going to industrial countries. While in the near future domestic consumption is likely to absorb most of the increases in production of these commodities, it is possible that Brazil will be able to continue and expand exports of manufactured goods into the 1970's, but at a somewhat slower pace than in the 1960's.

4. The Growth Record of Brazilian Exports and an Evaluation of the Elasticity Conditions Facing Brazil's Exports

There are several aspects of Brazil's exports that are worth stressing even at the expense of some repetition. In 1964-65, nine primary commodity exports constituted about 80 per cent of the total value of Brazil's exports.[44] This is a somewhat lower proportion than was the case in the mid-1950's; e.g., in 1954-55 the proportion of these nine commodities was about 94 per cent. Taking SITC 0, 1 and 2 as a whole, they accounted for about 89 per cent of the value of Brazil's exports in 1964-65. About 81 per cent of these primary exports were marketed in non-Communist industrial countries; Latin America with about 8 per cent and Eastern Europe with about 6 per cent were clearly of secondary importance. Exports of manufactures (SITC 5, 6, 7 and 8), while rising rapidly during the

1960's, amounted only to 8.5 per cent of total exports as late as 1966-67. The largest share of manufactures exports went to Latin America, with the industrial countries and especially the United States an important secondary market.

Michaely's concentration index computed for 1954 ranked Brazil fourth among 44 countries in terms of its commodity weighted share of world trade.[45] This index reflects on one hand the size of the country's export bill relative to world exports and on the other, the degree of commodity concentration of exports. If one were to compute Brazil's index of exports' concentration for 1964 one would find, I think, considerable change in her ranking. This would be the result of two factors. First, the share of Brazil's exports in world trade declined from about 2.4 per cent in 1954 to less than one per cent in 1966-67 (.8 per cent to be exact). The second reason is some fall in importance of the country's traditional exports of coffee, cocoa and cotton in her total exports. This was a direct result of the unfavorable growth record of Brazil's three major commodity exports: coffee, cocoa and cotton, during the 1953-66 years. Coffee exports declined at the rate of 2.6 per cent a year, cocoa exports declined seven per cent a year and cotton exports were virtually unchanged. Only two commodity exports experienced rapid growth over this period:

sugar (13.3 per cent a year) and iron ore (12 per cent a year).[46] However, their weight in the total export bill was too small to reverse the negative overall trend.

In order to get a better understanding of Brazil's export performance, I turn to the various export aggregates based on SITC categories (reported in Tables A.3 and A.4). Total exports during 1953-66 rose at the average annual rate of about one fourth of one per cent. When only non-coffee exports are considered, the rate of growth was somewhat more impressive, 4.2 per cent a year. It was the non-manufacturing exports, especially the SITC 0 and 1 categories, that retarded the overall growth of Brazil's exports. Exports of food, beverages, and tobacco (SITC 0 and 1) had a <u>negative</u> growth rate of 1.5 per cent a year over the 1953-66 period. During the same period exports of manufactures (SITC 5, 6, 7 and 8) grew at the exceptional rate of 20 per cent per year. The performance of Brazil's exports in constant 1953 prices (Table A.4) was somewhat more impressive. Total exports grew at the annual rate of about 2.5 per cent and non-coffee exports at the annual rate of about 6.5 per cent during 1953-66.

Brazil's exports, in constant 1953 prices, increased from an annual average of $1517.4 million in 1953-56 to about $1898.5 million in 1963-66. Non-coffee exports in constant 1953 prices averaged $525.5 million in

TABLE A.3.--Annual growth rates (compound) and linear trends of Brazilian exports, based on SITC categories, 1953-66.

	Food, beverages and tobacco SITC 0 & 1		Crude materials excluding fuels SITC 2		SITC* 0 + 1 + 2 + 3		Basic manufactures, machines & transport equipment SITC 6 & 7		Total manufacturing exports SITC 5,6,7,8		Total Exports		Total non-coffee exports	
	b	r	b	r	b	r	b	r	b	r	b	r	b	r
1953-57	-36.80	-3.13	-7.87	-2.58	-44.11	-3.05	2.45	59.59	2.58	19.51	-37.52	-2.51	1.64	.73
1957-61	-21.80	-2.06	16.12	6.26	-2.19	-.15	2.85	22.20	6.12	25.39	4.85	.36	21.57	4.9
1961-66	42.09	4.33	23.37	6.59	61.29	4.57	18.64	45.18	20.17	31.47	81.70	5.63	66.30	8.9
1953-66	-15.88	-1.47	11.22	3.68	-4.46	-.34	6.46.	26.23	7.85	20.02	4.63	.26	27.57	4.2

Source: See Data Appendix (Appendix D).

Notes: b = average increase of exports in dollars per year.
r = average annual rate of growth of exports compounded.
* = SITC 3--mineral fuels.

TABLE A.4.--Annual growth rates (compound) and linear trends of Brazilian exports in constant (1953) prices.

	SITC 0 + 1		SITC 2		SITC 6 + 7		SITC 5 + 6 + 7 + 8		Total Exports		Total non-coffee exports	
	b	r	b	r	b	r	b	r	b	r	b	r
1953-57	31.41	2.89	-3.65	-.85	3.93	70.35	5.24	35.18	31.01	2.10	27.94	5.50
1957-61	101.4	7.71	30.32	10.46	5.08	23.42	10.84	26.64	122.6	7.41	88.61	12.29
1961-66	6.52	.307	43.29	9.45	59.83	59.94	68.53	44.84	-2.73	-.173	29.06	3.00
1953-66	33.09	2.54	23.49	6.42	19.94	40.43	25.21	31.44	41.23	2.47	46.24	6.52

Source: See Data Appendix (Appendix D).

Notes: b = average increase of exports in dollars per year.
r = average annual rate of growth of exports compounded.

1953-56, rising to $972.4 million in 1963-66.[47] Between the two periods, total exports increased by 25 per cent and non-coffee exports by 85 per cent. Therefore, we may conclude that the unimpressive growth of Brazil's exports resulted largely from the poor export performance of its single largest commodity export, coffee.

Brazil's capacity to import, based on its exports earning alone, has improved somewhat during the 1960's, but is still lower than in the record year of 1954 (see Table A.5). When the income terms of trade were computed based on earnings from non-coffee exports alone, a marked improvement in Brazil's export-based capacity to import was observed.[48] Finally, the contribution of Brazil's exports to the country's gross domestic product declined from the high of ten per cent in 1950 to less than seven per cent in 1965 (see Table A.6). Thus, Brazil's exports, though rising somewhat in absolute terms, decreased in their relative importance to the domestic economy.

Regrettably, nothing definite can be said concerning the world demand elasticity for Brazil's exports. Previously I found that several of Brazil's primary commodity exports face a price inelastic <u>world</u> demand; coffee, cocoa, cotton and tobacco were specifically discussed. Yet even if the overall world demand for these commodities is inelastic, the demand for Brazil's exports may be elastic.[49]

TABLE A.5.--Index numbers of the value of Brazil's exports, import prices and income terms of trade.*

	(1)	(2)	(3)		
Year	Value of exports	Value of exports except coffee	Import price	Income terms of trade	
				(1)/(3)	(2)/(3)
1950	88	109	93	94	117
1951	115	158	112	103	141
1952	92	83	115	80	72
1953	100	100	100	100	100
1954	101	136	67	150	203
1955	92	128	79	116	162
1956	96	100	70	137	143
1957	90	121	78	115	155
1958	81	123	71	114	173
1959	83	122	65	128	188
1960	82	123	69	119	178
1961	91	154	73	124	211
1962	79	127	80	99	159
1963	91	146	78	116	187
1964	93	149	78	120	191
1965	104	197	83	125	237
1966	113	217	87	130	249

Source: Fundacao Getulio Vargas, <u>Conjuntura Economica</u>, XXII (February, 1968).

Notes: *The income terms of trade are defined as the value of exports (index) divided by price of imports (index).

TABLE A.6.--Brazil's gross domestic product, exports and the ratio of exports to GDP in constant 1960 prices.

Year	Gross domestic product	Exports of goods and services	Ratio of exports to GDP (percent)
	(Thousands of millions of cruzeiros)		
1950	1361.5	139.9	10.2
1956	1853.6	157.2	8.5
1960	2418.8	173.5	7.1
1965	2973.4	205.6	6.9

Sources: ECLA, <u>Economic Survey of Latin America 1964</u> (New York: United Nations, 1966), p. 73, Table 52.

ECLA, <u>Economic Survey of Latin America 1966</u> (New York: United Nations, 1968), p. 103, Table 70.

Because of Brazil's dominant-supplier position in world coffee markets it is likely that she is facing price inelastic demand for this commodity in world markets. However, it must be realized that Brazil's central role in world coffee trade has been steadily diminishing (see Table A.7) over the post World War II period, thus

TABLE A.7.--Brazil's share of world trade of certain major primary exports (percent); various years.

Commodity export	1948-52	1960	1961
Coffee	51.9	38.5	37.6
Cocoa	14.1	13.9	10.2
Cotton	5.8	2.8	6.3
Sugar	.009	4.7	4.3
Tobacco	4.9	4.1	5.8

Source: Werner Baer, Industrialization and Economic Development in Brazil (Homewood, Ill.: Richard D. Irwin, 1965), p. 39, Table 3-4.

making even that assertion rather tenuous. As regards the other primary commodity exports such as cocoa, cotton, sugar and tobacco: The world demand for Brazil's exports of commodities is most likely highly elastic, although the overall world demand is inelastic. This is because in those commodities Brazil's share of world trade is quite small (see Table A.7). If I may hazard a cautious guess, I would say that world demand for Brazil's "major" commodity exports including coffee is likely to be elastic (but just barely over the -1.0--unit-elastic point). This guess hinges on the implicit assumption that the world demand for Brazil's coffee exports (and possibly cocoa as well) is in fact inelastic, but as regards the other commodity exports (i.e., sugar, cotton, tobacco, iron ore, etc.) it is elastic.

Following World War II the share of coffee and cocoa in total Brazilian exports has generally declined. Yet as late as 1964-65, those two commodities (coffee and cocoa) comprised just over 50 per cent of the country's total exports. In particular, coffee alone accounted for about 48 per cent of total Brazilian exports in 1964-65.[50] Based on these tenuous considerations I surmise that Brazil "just barely misses" facing an inelastic demand for its exports in world markets. Yeager noted that the possibility of a country facing an inelastic world demand for its exports is enhanced if a large proportion of the country's exports consist of a few commodities for which world demand is very inelastic, and if in addition it does not face "considerable" competition in world markets.[51] Based on these vague guidelines, I think that Brazil is a "borderline" case whereby she "just" faces an elastic world demand for her exports. Because of the dearth of concrete evidence in this area I cannot be any more definite in my assessment.

B. Brazil's Imports

1. Available Estimates of the Brazilian Import Function

In contrast with her exports, Brazil's imports are well distributed among different import categories. Yet the value and volume of Brazil's imports have fluctuated quite sharply with the availability of foreign currency to pay for them.

Recently two studies attempted to estimate the import demand function for Brazil. Clark and Weisskoff hypothesized that imports depend on three main factors--the pace of domestic activity, the prices of potential imports relative to their domestic substitutes, and the long run trend of import substitution.[52] They used as an income variable the GNP at fixed 1953 prices; however, in some of the regressions, because of the existence of multi-collinearity, they substituted gross fixed capital formation for the income variable. In place of the relative price variable they used the ratio of "total" protection index (i.e., tariffs plus exchange premiums) for the domestic price index. The trend in import substitution was represented simply by a time variable. Through the use of multiple regressions for the years 1953-65, they obtained a set of ten import demand functions. These functions were found to be related in a significant way to the "income" variable, the relative "price" variable and a time trend. Three of the ten estimated equations are reproduced in Table A.8.

TABLE A.8.--Import demand function for total imports and two use classes.†

1. All imports:

$$M = 910.40 + \underset{(2.47)}{15.95^{*}K} - \underset{(1.39)}{3.60^{*}P_t} - \underset{(8.30)}{50.05\ T} \qquad R^2 = .84$$

2. Consumer goods imports:

$$M_c = 184.56 + \underset{(.53)}{.39\ K} - \underset{(.19)}{.63^{*}P_c} - \underset{(1.88)}{.65\ T} \qquad R^2 = .71$$

3. Capital equipment for industry:

$$M_k = 24.08 + \underset{(.96)}{5.32^{*}K} - \underset{(.59)}{.72P_k} - \underset{(3.89)}{15.71^{*}T} \qquad R^2 = .78$$

Source: Paul Clark and Richard Weisskoff, Import Demand and Import Policies in Brazil, Research Memorandum No. 8 (Williamston, Mass.: Center for Development Economics, Williams College, February, 1967), pp. 52-53.

Notes: † M, M_c, M_k = imports in million U. S. dollars.

K = gross fixed capital formation in billion cruzeiros.

P = ratio of index of total protection to the relevant index of domestic price (overall, P_t, or in each use category, P_c, P_k).

T = time, with the year 1952 set equal to zero.

* = statistically significant at the 10 per cent level. The numbers in parentheses are the standard errors of the regression coefficients.

The gross fixed capital formation variable gave "better" results than the GNP variable in the various import demand functions. The effects of fluctuations in gross investments upon import demand turned out to be substantial. The estimated elasticity of all imports relative to gross fixed capital formation was about one. The estimated elasticities of imports in three classes of capital equipment (Agriculture, Industry and Transport) for construction material and for intermediate goods ranged from 1.3 to 2.1. Thus the Clark and Weisskoff results imply that a rise in investment would not only lead to increased imports but would tend to affect the composition of imports in a significant way. The relative price variable appeared to be related significantly to total import demand and also to imports in six out of the nine use classes. The regression coefficients were negative and significant in four out of six cases.[53] (See Table A.9 for the elasticity estimates of the import functions.)

In two categories of imports--metallic intermediate goods and construction materials--the price elasticity coefficient was greater than one; however, the price elasticity coefficient for all imports turned out to be smaller than one, i.e., inelastic. Therefore, changes in the level of protection that in turn change the price of landed imports would be expected to have a noticeable

TABLE A.9.--Import demand elasticities and percentage trends of imports.

		Elasticity relative to gross fixed capital formation	Price elasticity of import demand	Percentage trend relative to time
1.	Total imports	1.050*	-.407	-3.9*
2.	Consumer goods	.295	-.925*	-.58*
3.	Metallic intermediate imports	1.958*	-1.238*	-4.48*
4.	Non-metallic intermediate imports	.735*	-.460*	-3.09*
5.	Construction materials	1.325*	-1.623*	-8.18*
6.	Capital equipment for agriculture	1.814*	-.812	-7.35
7.	Capital equipment for industry	1.678*	-.349	-5.97*
8.	Capital equipment for transportation	2.078*		-12.10*

Source: Paul Clark and Richard Weisskoff, Import Demand and Import Policies in Brazil, Research Memorandum No. 8 (Williamston, Mass.: Center for Development Economics, Williams College, February, 1967), p. 54.

Note: * Statistically significant at 10 per cent level.

effect on the level of imports. The time trend that Clark and Weisskoff saw as reflecting the long run process of import substitution turned out also to be significant. As a result of the import substitution processes, the import bill was reduced by about four per cent a year, or an equivalent annual reduction of some $50 million. This trend was considerably larger for the three classes of capital goods and almost negligible in the case of consumer goods.[54]

The results of a later study by Samuel Morley generally corroborate the Clark and Weisskoff estimates.[55] Morley did not obtain the income elasticity of imports directly from the regression equations because of the existence of multi-collinearity; rather he derived it from international comparisons and budget studies.[56] His estimates of the elasticity of total imports with respect to prices of imports, gross fixed investment and output were as follows:

Relative price of imports	-.63
Gross fixed investment	.85
Brazilian output	-.77

The last figure gives an indication of the intensity of the import substitution process; a 10 per cent increase in domestic output will on the average reduce import requirements by 7.7 per cent.[57]

In sum, these studies derived an empirically meaningful import function for Brazil. Both studies concluded that during the period under investigation variations in imports can be satisfactorily "explained" by an "income" variable, a relative price variable and a proxy variable for the import substitution process.

2. Import Substitution and the Growth Record of Brazil's Imports

After World War II industrialization became the central goal of Brazil's economic planning, with the stated purpose of drastically altering the structure of the whole economy. This was due to the realization that Brazil could not attain a high and steady rate of growth by relying chiefly on exports of primary commodities. Import substitution became the main tool of that strategy of economic development.

Hirschman noted several reasons that led to the choice of import substitution as a development policy for Latin America. Historically, wars and depressions give a country the impetus to start producing domestically the manufacturing goods that it was unable to obtain through importation or due to shortages of foreign exchange. In addition, import substitution results from the gradual expansion of the economy, raising incomes and furthering the growth of domestic markets. Finally, import substitution in Brazil and in some other Latin American countries was undertaken as a matter of deliberate development policy.[58]

Substitution is likely to start at the "point of least resistance," i.e., by producing finished consumer goods. The technology in these industries for the most part is relatively uncomplicated and the capital-labor ratio low (e.g., in the textile industry) compared to the more sophisticated industries. The existence of an untapped domestic market as indicated by the prevailing volume of imports would be the "green light" for initiating import substitution. The initial experience with import substitution is likely to be satisfying to domestic producers, in that the domestic market is effectively closed to foreigners by means of trade and/or exchange restrictions, while the manufacture of domestic goods is subsidized through imports of materials and parts at preferential exchange rates. Also, the chronic Balance of Payment deficits that many underdeveloped countries experience reinforce the apparent desirability of the policy previously described.

However, there are some serious drawbacks to this policy. The import substituting country may adopt production and marketing methods used by developed nations in an economic environment that is completely different. Harry Johnson, referring to attempts at import substitution by less developed countries, noted:

> . . . such a policy is likely to transform it [the less developed country, T.C.L.] into a miniature replica of the economies of the advanced countries, though less efficient and technologically laggard to an extent depending on the size of the domestic market and the degree of protection employed.[59]

The first stages of import substitution may be relatively painless and the excess cost of domestically produced goods above world market prices may be offset in part by the higher growth of real output and other longer run benefits arising out of industrialization. However, the progressive extension of this policy is likely to encounter rising costs as substitution extends to goods whose efficient production depends on a large market demand or on producing domestically specialized parts and on provision of sophisticated services that only a large diversified economy can provide. The resulting expansion of output in the "early" industries, established through a policy of import substitution, and the consequent reduction in their cost will be more than outweighed by the further replacement of imports by higher-cost domestic products.[60] At an advanced stage of import substitution, the potential increases in real output of goods could be easily wasted because of the "luxury" of high cost local production of additional goods previously imported.

Since the trend of Brazilian imports was essentially horizontal, while income was rising rapidly, the net result was an overall decline in the average propensity to import.[61] A United Nations study shows that for the period 1945-54 the average propensity to import goods and services was 11.5 per cent as compared to

TABLE A.10.--Import coefficients* of selected Latin American countries, 1960-66.

	1960	1961	1962	1963	1964	1965	1966
Brazil	9.9	8.4	7.6	7.4	5.7	5.1	6.6
Argentina	11.9	13.2	12.9	10.4	11.2	10.3	8.8
Mexico	11.8	11.2	11.1	11.3	11.9	11.7	11.5
Chile	13.9	16.3	13.3	12.6	12.3	12.3	12.1
Latin America ex. Cuba	11.9	11.7	11.5	10.9	11.1	10.6	11.1

Source: ECLA, Economic Survey of Latin America 1966 (New York: United Nations, 1968), p. 23, Table 8.

Note: * Measured as the value of goods and services imports as a percentage of the GDP.

TABLE A.11.--Trend of per capita imports* of selected Latin American countries, 1960-66 (dollars per capita).

	1960	1961	1962	1963	1964	1965	1966**
Brazil	26	23	21	20	17	18	20
Argentina	67	76	73	55	64	63	59
Mexico	41	39	39	41	46	47	48
Chile	85	93	86	81	84	82	93
Latin America ex. Cuba	47	46	47	44	47	47	50

Source: ECLA, Economic Survey of Latin America 1966 (New York: United Nations, 1968), p. 23, Table 7.

Notes: *Imports of goods and services.
**The 1966 figures are provisional estimates.

8.6 per cent for the 1955-61 period.[62] During 1953-56 imports in constant 1953 dollars averaged $1793 million; in 1963-66 imports were about $1642 million per annum, an average decline of $151 million per year.[63] Given the low import coefficient at the outset of the major import substitution effort of the 1950's, there is a clear limit to the future decline in the import coefficient. In any case, substitution does not necessarily entail a contraction in the absolute volume of imports, but it simply means that they increase at a slower pace than domestic product. In Brazil the process of import substitution in addition involved a change in the relative importance of various categories of imports.

The rapid decline of consumer goods as a proportion of total imports is clearly evident (see Table A.12).

TABLE A.12.--Composition of category imports as a proportion of total Brazilian imports (percentage).

Imports	1948-49	1959-60
Consumer goods	15.5	6.4
Durable consumer goods	8.4	1.5
Fuels	11.4	17.3
Raw materials and intermediate goods	30.1	36.7
Metallic intermediate goods	6.9	6.3
Capital goods	39.5	43.2
Machinery and equipment for transport	19.1	3.5
Machinery and equipment for industry	20.4	14.9

Source: The Economic Development of Latin America in the Postwar Period (New York: United Nations), p. 116, Table 116.

Initially the overall decline was attributable mainly to import substitution in the non-durable consumer goods category. However, once a country attained a more advanced stage of industrial development import substitution extended to consumer durables as well. The pattern of imports of raw materials, fuels, and intermediate products is quite different. Although yearly fluctuations were observed, the overall trend was toward a substantial increase of their share in total imports. These three categories accounted for 47 per cent of total imports in 1950, their share rising to about 53 per cent in 1960-61 and exceeding 60 per cent in 1964-65. Lastly, the share of capital goods in aggregate imports followed a pattern of its own. It increased during the first stages of the sustained import-substitution effort, remained fairly constant at a high level for a period, and then eventually started to decline.[64]

This pattern corresponds to a rational graduation of the import substitution process. First come the simple types of manufactured goods, often characterized by lower capital intensity, smaller economic production scale and generally less exacting technological requirements. At a later stage the substitution process is extended to more complex products, including the manufacture of consumer durables, intermediate products and capital goods.

A complementary way of analyzing the import substitution process is to compute the value of imports as a proportion of the total supply of that category of goods, over time. Such a comparison for three years is presented in Table A.13. It is evident from Table A.13 that in all but two categories (rubber and beverages) the share of imports in the total supply (i.e., domestic production plus imports) declined between 1949 and 1961. An overall measure of the extent of the import substitution process is provided by the fact that the average manufacturing "import quotient" fell from 16 per cent in 1949 to about 10 per cent in 1961.

It is noteworthy that certain industries were more important than others from the viewpoint of import substitution--for in the "traditional" industries, such as textiles, clothing and food products, the coefficients were already quite low in 1949, limiting the possibilities of further substitution. On the other hand, some of the "dynamic" industries, e.g., transport equipment, electrical equipment, chemicals and metal products, experienced considerable import substitution based on this criteria.

Huddle observed that future possibilities of growth stimulated by vigorous import substitution would be limited. Only in the "dynamic" industries would more than a token degree of import substitution be likely to take place. Moreover, a major import substitution effort

TABLE A.13.--Imports as a percentage of total production plus imports for Brazil's manufacturing industries--1949, 1958, 1961.

Industry	1949	1958	1961
Metallurgy	22.3	11.7	11.7
Matal-transforming	63.8	41.5	46.3
Electrical and communications equipment	44.8	13.3	16.9
Transport equipment	56.6	30.5	18.6
Chemicals and pharmaceuticals	29.3	20.0	17.4
Processing of non-metallic ferrous ores	10.1	5.1	4.4
Paper and paperboard	9.6	5.3	7.2
Rubber	1.3	6.5	14.7
Wood products	1.0	1.0	.7
Textiles	6.2	.6	.6
Clothing, footwear	.2		
Food products	3.8	2.5	2.2
Beverages	2.4	2.6	2.6
Tobacco	.4		
Printing and publishing	2.2	3.0	
Furniture	.3		
Hides and skins	3.0	.7	
Average	15.6	11.3	9.7

Source: Adapted from ECLA, "The Growth and Decline of Import Substitution in Brazil," Economic Bulletin for Latin America (March, 1964), p. 40, Table 25.

in those industries ought to be questioned on the ground that Brazil will be approaching a state of autarchy in several important sectors. In fact, it can be argued that since Brazil has already one of the lowest import coefficients in the world, an increase in international trade along the lines suggested by comparative cost criteria will bring increased gains to the country.

Furthermore, Nathaniel Leff has attributed the decline in Brazil's growth rate since 1962 to the lagging supply of imports during the early 1960's.[65] Since the proportion of consumption goods in Brazilian imports has been greatly reduced in the past the main effect was on the imports of raw materials and producers equipment. Leff suggested that it was the restricted supply of imported raw materials and intermediate products that was responsible for the sharp decline in the growth rate of industrial output.[66] Leff's hypothesis "explains" the recent Brazilian recession in terms of factors on the supply side, contrary to the official explanation, that lists deficiency of aggregate demand as the main contributory factor.[67]

An ECLA study pointed out that from the macroeconomic standpoint further import substitution may even tend to slow down economic growth.[68] Given the type of products that currently constitute the range of substitutable imports, further substitution would lead to investment in projects with high capital-output ratios. Thus, to attain the rate of growth experienced in the 1955-61 period, a more intensive rate of investment must be achieved than has been realized so far.

Given that Brazil's import coefficient is one of the lowest in the Western world, its maintenance at the present level would imply a substantial increase in the rigidity of the import schedule.[69] In fact, Brazil's development process can be seriously hampered by the stagnancy of its imports (see Leff's hypothesis above). These considerations brought forth the following note in the ECLA study:

> All that has been said so far bears out the argument that the strategic problem confronting the Brazilian economy is how to make the transition from an import substitution model to a self-sustaining growth model.[70]

In fact, this comment may be applicable to several less developed countries that have reached the same stage in their development.

FOOTNOTES: APPENDIX A

[1]In a recent study, B. I. Cohen calculated the annual growth rates of primary products imports of the major industrial countries from the less developed countries. Cohen computed the growth rates over the period for 1952-54 to 1962-64. The growth rates of the commodities that are of the major concern to Brazil were: coffee, -1.4 per cent; cocoa, -2.9 per cent; cotton, -2.9 per cent; sugar, +2.7 per cent; and tobacco, +4.2 per cent.

See: B. I. Cohen, "The Less Developed Countries' Exports of Primary Products," Economic Journal, LXXVII (June, 1968), 334-43, Table III and IV.

[2]Since the Korean War, coffee prices have rebounded for several years. In 1954 frost damage in Brazil sent prices of santos no. 4 (in New York) soaring to a 79 cents per pound average for the year. But since 1958 prices of coffee have been generally on the decline, reaching a low of about 34 cents per pound in 1962-63, and rebounding to about 43 cents per pound in 1965-66.

[3]The four largest African exporters are: Uganda, The Congo, Kenya and Tanzania. See: B. Balassa, Trade Prospects for Developing Countries (Homewood, Ill.: Richard D. Irwin, 1964), p. 197.

[4]The lower prices and favorable technical characteristics of the Robusta (African) brand relative to Brazil's brand led to their increasing use in the production of soluble (i.e., "instant") coffee. A study based on United States data for the period 1953-63 found the elasticity of substitution between Robusta's and Brazil's to be -.98.

See: G. Lovasy and L. Boissonneault, "The International Coffee Market," IMF Staff Papers (November, 1964), 378-80.

[5]Baer, op. cit., p. 39, Table 3-4. Also: ECLA, Economic Survey of Latin America, 1964 (New York: United Nations, 1966), p. 239, Table 236.

[6]Rex F. Daly, "Coffee Consumption and Prices in the United States," Agricultural Economics Research, X (July, 1958), 61-71.

[7]Calculated from: Balassa, Trade Prospects . . ., op. cit., p. 201.

[8]The two different figures arose because of different assumptions regarding growth of income in the industrial countries. They also depend on the assumption that export quotas for coffee will be extended within the framework of the International Coffee Agreement, so as to prevent any sharp declines in coffee prices. On May, 1967 the Agreement included 38 exporting countries, accounting for 99.1 per cent of world exports of coffee and 23 importing countries accounting for 96 per cent of total imports.

See: Ibid., p. 204.

[9]Cohen, op. cit., 339, Table IV.

[10]For detailed exposition of this policy see: Leff, op. cit., pp. 20-32.

[11]In this model the largest firm may be maximizing profits by setting a higher price than would be consistent with the operations along the long run demand curve for the industry. This policy of high pricing encourages entry of new competitors into the market (re: the growing share of the African producers) and thus reduces the share of the major supplier in the market.

See: George Stigler, The Theory of Price (New York: MacMillan, 1952), pp. 232-34.

[12]These figures refer to exports of cocoa beans as well as cocoa butter and paste. See: Baer, op. cit., p. 39.

[13]Ibid., p. 36.

[14]The 1964-65 figures are reported fully in the Data Appendix. The industrial countries include the following: United States, Canada, Western Europe and Japan.

[15]Balassa, Trade Prospects . . ., op. cit., pp. 206-08. The FAO study used the following income elasticities for cocoa--in the United States, Canada and United Kingdom: (.0); EEC countries: (.30); other Western Europe: (.20).

Taken from: FAO, Agricultural Commodities--Projection for 1975 and 1985 (Rome: FAO, 1967), p. 52, Table I.23.

[16] For example the FAO study employed the following price elasticities of demand for cocoa--North America (-.20); EEC (-.30); other Western Europe (-.40). Taken from: FAO, op. cit., p. 52, Table I-23.

[17] Behrman used the standard least squares multiple regression method on the one hand, and a two stage least squares estimating procedure using instrumental variables, on the other hand.

See: J. Richard Behrman, "Cocoa: A Study of Demand Elasticities in the Five Leading Consuming Countries, 1950-1961," Journal of Farm Economics, XLVII (May, 1965), 410-17.

[18] Calculated from the Data Appendix (Appendix D).

[19] Balassa, Trade Prospects . . ., op. cit., pp. 240-57.

[20] J. R. Donald, F. Lowenstein and M. S. Simon, "The Demand for Textile Fibers in the U. S.," U. S. Department of Agriculture, Economic Research Service, Technical Bulletin no. 1301, November, 1963. (Mimeographed.)

[21] Ibid., pp. 59-62.

[22] For detailed analysis see: FAO, op. cit., pp. 281-82.

[23] Balassa projects a two to three per cent increase in sugar imports between 1960 and 1970. See: Balassa, Trade Prospects . . ., op. cit., pp. 183-84, also: FAO, op. cit., p. 190.

[24] FAO, op. cit., p. 217.

[25] These prospects will depend to a considerable degree on the agricultural imports policy of the EEC. See: Balassa, Trade Prospects . . ., pp. 185-90.

The FAO study forecast shows that the projected import requirements of the industrial countries in 1975 are likely to increase more than the exports availabilities of the developing countries and Eastern Block countries. This may lead to some upward adjustments in world tobacco prices. See: FAO, op. cit., p. 217.

[26] S. M. Sachrin, "Factors Affecting the Demand for Cigarettes," Agricultural Economic Research, XIV (July, 1962), 81-88.

[27] A. P. Koutsoyannis, "Demand Function for Tobacco," The Manchester School of Economics and Social Studies, XXXI (January, 1963), 1-20.

[28] Hides and skins were largely exported to the United States (41 per cent) and the EEC (34 per cent). Rubber was mainly marketed in the United States (46 per cent) and Latin America (48 per cent). The central markets for forest products were Western Europe (42 per cent) and Latin America (51 per cent).

All figures pertain to the 1964-65 period and were calculated from the Data Appendix.

[29] Cohen, op. cit., 339, Table IV.

[30] The alternative estimates are based on different projections of the rate of growth of income in industrial countries. See: Balassa, Trade Prospects . . ., op. cit., pp. 291-98.

[31] From 6,236 thousant metric tons to 14,279 thousant metric tons in 1967. From: Survey of the Brazilian Economy, 1966 (Washington, D. C.: Brazilian Embassy, December, 1967).

[32] Calculated from my Data Appendix (Appendix D).

[33] For details see: Lee, "Brazilian Exports of Manufactured Goods," Conjuntura Economica, XIII (May, 1966), 45-50.

[34] These data refer to the 1964-65 period.

[35] In 1967 the imports of textile products (SITC 651, 652 and 655) were only about $3 million. For U. S. imports of textiles (SITC 65) see: Lary, op. cit., p. 117, Table 17.

For Brazil's exports of textiles (SITC 65) see: United Nations, Commodity Trade . . ., op. cit.

[36] It is of interest to note that the 1966-67 annual exports of Brazilian chemicals alone exceeded the combined export of all manufactured goods in 1960.

See: Lee, op. cit., 46, Table I.

[37] The other countries were: Argentine, Chile, Columbia, Mexico and Peru. See: ECLA, The Process of Industrial Development in Latin America (New York: United Nations, 1966), p. 103

[38]Brazil's consolidated steel industry came to represent the largest productive capacity in Latin America and was composed of the largest number of integrated plants. See: Ibid., p. 105

[39]ECLA, Economic Survey of Latin America--1965 (New York: United Nations, 1967), pp. 312-13.

[40]Imports of iron and steel, averaged about $60 million over the 1964-67 period.

[41]These figures include exports of automotive parts and accessories.

[42]Prior to 1957 only assembly and some automotive parts production existed in Brazil. See: Gordon and Grommers, op. cit., Chapter IV.

[43]A recent study compared the cost of automotive production amongst three Latin American countries. Munk found that relative to Argentina and Mexico, Brazil was the low cost producer of motor vehicles in Latin America. See: Bernard Munk, "The Welfare Costs of Content Protection: The Automotive Industry in Latin America," Journal of Political Economy, LXXVII (January/February, 1969), 85-98.

[44]These primary exports are: fruits and vegetables (SITC 05), sugar (SITC 061), coffee (SITC 071), cocoa (SITC 072), hides and skins (SITC 211), oil seeds, nuts, etc. (SITC 221), lumber (SITC 243.2); cotton (SITC 263), iron ore and other nonferrous base metals (SITC 281 and 283). See Data Appendix for further details.

[45]Michaely's index is:

$$100 \sum_i \left[\frac{X_{ij}}{X_i} \frac{X_{ij}}{X_j} \right]$$

Where: X_{ij} = the exports of commodity i, by country j

X_i = world exports of commodity i

X_j = total exports of goods of country j

See: Michaely, Concentration . . ., op. cit., Chapter 3.

[46]The annual growth rates of these commodities were computed from sources listed in the Data Appendix.

The formula for calculating compound growth rates was obtained from: Daniel B. Suits, Statistics: An Introduction to Quantitative Economic Research (Chicago: Rand McNally Co., 1963), Chapter IX, pp. 203-211.

[47]Computed from the Data Appendix.

[48]Income terms of trade = $\frac{V_x}{P_m}$ where V_x is the index number of the value of exports and P_m is the price index of imports.

For details see: Gerald M. Meier, The International Economics of Development: Theory and Development (New York: Harper & Row, 1968), Chapter 3, pp. 43-44.

[49]The rationale for this statement is contained in the following formula:

$$\eta_x = \frac{1}{A} \eta_w + \frac{B}{A} \varepsilon_c$$

Where: η_x = the world demand elasticity for a commodity export, supplied by Brazil.

η_w = the world demand elasticity for that commodity.

ε_c = the elasticity of export supply for that commodity from countries competing with Brazil.

A = Brazil's share of the world exports of that commodity.

B = competitors share of world markets.

See: Yeager, op. cit., p. 140, footnote 4.

[50]Calculated from Data Appendix.

[51]Yeager, op. cit., pp. 139-40.

[52]Clark and Weisskoff, op. cit.

[53]Ibid., pp. 52-53, Table C-4A.

[54]Ibid., pp. 11-12.

[55]Morley included in his estimates the price of Brazilian goods in the relevant category relative to the general price index. The rationale for inclusion of the second relative price ratio was to enable him to test the hypothesis that only relative prices of imports and close substitutes were relevant to import demand.

See: Samuel A. Morley,"Import Demand and Import Substitution in Brazil," Brazil Development Assistance Program, University of California, Berkeley, Calif., no date. (Mimeographed.)

[56]*Ibid*., p. 9

[57]*Ibid*., p. 19.

[58]Hirschman, *op. cit*., 1-32.

[59]Harry G. Johnson, "Tariffs and Economic Development: Some Theoretical Issues," *Journal of Development Studies*, I (October, 1964), 3-30.

[60]For the "early" import substituting industries expansion will imply movement "downward" along the declining section of the industry's average cost curve. Establishment of additional industries through import substitution would lead to a higher average cost of production, because of the inability of the new industries to engage any significant economies of scale. The development of the automotive industry may be a demonstration of the latter point.

For the connection between market size and economies of scale in motor vehicle production see: Munk, *op. cit*., pp. 85-98.

[61]During the period 1953-66 the annual growth (negative) rate of imports (in current dollars) was -.32 per cent; while in the same period in constant 1953 dollars imports *decreased* by .65 per cent a year.

[62]United Nations, *The Economic Development of Latin America in the Postwar Period* (New York: United Nations, 1964), p. 114, Table 113.

[63]Calculated from statistics in the Data Appendix.

[64]Leff in a detailed study of the Brazilian capital goods industry noted the increase in the share of domestic output in the total purchases of producers equipment over time. In the late 1940's the domestic industry supplied about 60 per cent of the market for capital equipment in Brazil, its share rising to 75 per cent by 1957-59. This increase in the domestic industry's market

share took place while demand for capital equipment was rising steadily. In 1959 the value of equipment supplied by domestic sources was approximately 115 per cent higher than in 1947.

See: Leff, The Brazilian Capital Goods . . ., op. cit., Chapter VI.

[65]Brazil's net domestic product increased at the average rate of 6.7 per cent during 1956-62, while rising only at the rate of 2.6 per cent during 1962-66.

See: ECLA, Economic Survey . . ., op. cit., pp. 101-02, Table 69.

[66]Nathaniel H. Leff, "Import Constraints and Development: Causes of the Recent Decline of Brazilian Economic Growth," The Review of Economics and Statistics, XLIX (November, 1967), 494-501.

[67]See for example: J. Bergsman and S. Morley, "Import Constraints and Development: Causes of the Recent Decline of Brazilian Economic Growth: A Comment," The Review of Economics and Statistics, LI (February, 1969), 101-102.

[68]ECLA, "The Growth and Decline of Import Substitution in Brazil," Economic Bulletin for Latin America, IX (March, 1964), 1-59.

[69]Ibid., 26-27.

[70]Ibid., 57.

APPENDIX B

THE AVAILABILITY OF VARIOUS SKILL CATEGORIES IN BRAZIL

Engineers

In Chapter III the overall shortage of skilled personnel at all levels has been noted. This is especially true with regard to the supply of engineers. For example, the Brazilian capital goods producing sector employs 2.9 engineers per 100 employees as compared to 5.7 engineers per 100 employees employed in the United States electrical equipment and machinery industries.[1] Nathaniel Leff found that the salaries paid Brazilian engineers in the capital goods industry were 12 times the wages paid unskilled labor. This is in contrast to a ratio of 4.0 to 5.5 prevalent in several industrial countries.[2]

This large labor wage differential in Brazil exists because the supply of engineers has not kept pace with the rapidly expanding demand. This demand expansion resulted from the rapid growth of output in the manufacturing sector as a whole and in the heavy equipment industries in particular.[3] One reason that the supply of engineers has not kept pace with the growing demand is the inadequacy of existing educational facilities. In 1958, there were 9,786 candidates for 1,645 openings in the engineering schools, i.e., a ratio of 3.3 candidates per opening. While the number of openings rose to 6,556 in 1964, the ratio of candidates per opening in fact increased to 3.8 and was as high as 4.2 in the non-civil engineering field.[4] Thus, because of the slow expansion of engineering schools, excess demand for engineering education has developed; and it was exacerbated by the high quasi-rents paid to members of this profession. Despite the fact that the rate of increase of enrollment in engineering was faster than the overall increase in higher education enrollments, the serious shortages of engineers was not alleviated during the 1960's.[5]

Supply of Managerial and Administrative Personnel

Almost no evidence exists regarding the supply of these types of highly skilled personnel in Brazil. John Shearer studied at some length the personnel practices of a group of United States' subsidiaries in Mexico and Brazil.[6] Based on interviews and questionnaires, Shearer's findings generally confirmed the existing scarcity of highly qualified administrative and managerial personnel in Brazil. He succinctly remarked: "In both countries nationals who are well qualified to handle high-level positions in modern industrial operations are in very short supply."[7] He also discovered that United

States' subsidiaries lack the imagination to tap adequately the existing domestic supply of skilled personnel. Most of the companies rely on their own facilities for training and developing managerial personnel, usually consisting of recent college graduates.[8]

Shearer's study is of limited coverage because it deals only with United States subsidiaries in Brazil and Mexico. However, the 21 Brazilian subsidiaries included in the study cover most of the major manufacturing activities and the majority of these industries can be classified as "modern."[9] We can only surmise that conditions of employment and training of local management personnel in purely domestic enterprises lag behind those prevalent in the United States' subsidiaries.

The Shortage of Skilled Labor

Over the post World War II period the number of people with at least primary education (assumed to be the minimum educational input required of skilled labor) in Brazil has increased at an impressive pace.[10] As a result, the supply of skilled labor available to industry has expanded as well. It is estimated, for example, that the number of skilled workers in the metal-working industries in the State of Sao Paulo rose from 24,700 to 75,000 in the 1951-63 period, at a compound rate of 10.4 per cent annually.[11] Despite these impressive increases in the availability of skilled labor serious shortages prevailed as reflected in the high relative wage of such workers. The wages of master workmen relative to unskilled workers in Brazil's capital goods industry were between 30 and 90 per cent higher than those paid in several industrial countries.[12] The Ministry of Education estimated the country's "needs" for its basic and manufacturing industries at some 2,500 engineers, 5,000 industrial technicians and 60,000 skilled workers annually.[13] In comparison, between 1950 and 1959 it was estimated that the number of new engineers graduating averaged only about 980 a year.[14] In the light of past performance it is doubtful whether Brazil's system of education is capable of generating the projected numbers of engineers, technicians and other skilled workers needed to fill industries' demand. A study of the availability of trained technical personnel and skilled workers in the metal-working industry supports this skeptical attitude.[15] (See Table B.1 for additional information.)

The question that comes immediately to mind is whether the productivity of Brazilian labor has been markedly affected because of the lower educational input of these workers, relative to the United States and Western Europe.

An ECLA study found that the physical productivity of Brazilian labor in the heavy metal-transforming industry is only about 80 per cent below the labor

TABLE B.1.--Shortage of technical skills in the metal-working industry--1956.

	Total requirements	Fulfillment	Shortage
Specialized engineers	240	80	160
Industrial technicians	480	80	400
Skilled workers	10,000	4,500	5,500

Source: Based on a paper presented at a Latin American meeting of experts in steel-making and transforming industries; sponsored by ECLA, Sao Paulo, October 15-28, 1956. Cited in W. B. Dale, Brazil/Factors Affecting Foreign Investment Menlo Park, Calif.: International Industrial Development Center, Stanford Research Institute, September, 1958).

productivity in the United States and Germany, when similar capital equipment is used.[16] M. E. Kreinin compared the labor productivity of American firms producing in the United States and abroad under roughly similar capital and scale conditions.[17] Dr. Kreinin found that in Latin America labor "effectiveness" was some 30 per cent below the United States standard.[18] This difference in labor effectiveness was attributed about half of the time to lower educational inputs and inadequate training and skills.[19]

A study of the Brazilian textile industry found that in a sample of 204 cotton spinning mills only about 14 per cent of the variation in productivity can be attributed to obsolescent equipment and to mill size.[20] The study concluded that the explanation of most of the variations in productivity among Brazilian mills must lie in what it called the "human factors" involved in the production process. While not being able to isolate each one of these factors the study noted:

> The most important is mill management, including the whole concept of the entrepreneur's or manager's responsibility as regards use of satisfactory raw material, careful machinery maintenance, manpower training and so forth.[21]

Based on the ECLA study I can conclude that the lack of managerial and supervisory personnel was largely responsible for the low productivity in the textile industry and probably in other industries as well.

FOOTNOTES: APPENDIX B

[1]The Brazilian engineering coefficient has been adjusted to reflect employees of comparable output. See: Leff, The Brazilian Capital Goods . . ., op. cit., p. 49.

[2]The ratios of salaries of engineers to semi-skilled workers were: West Germany 4.0; Japan 5.0; United Kingdom 4.5; and United States 5.5. See: Ibid., p. 61.

[3]Estimated growth rates of output of mechanical equipment, manufacturing production and GNP, 1960-63. (percent)

Year	Mechanical equipment output	Manufacturing output	GNP
1960	14.0	11.1	6.7
1961	14.0	8.1	7.3
1962	20.0	- .3	5.4
1963	2.6	5.1	1.6

Sources: Leff, Ibid., p. 39, Table II-6.
ECLA, Economic Survey . . ., op. cit., p. 145, Table 95.

[4]John V. D. Saunders, "Education and Modernization in Brazil," in The Shaping of Modern Brazil, ed. by Eric N. Baklanoff (Baton Rouge, La.: Louisiana State University Press, 1969), p. 136, Table 6.

[5]While enrollments in higher education as a whole increased sixfold between 1940 and 1964, in engineering they increased more than eightfold and about 17.5 times in "economic sciences." In addition, a relative shift in enrollment took place toward professions that may be termed "modern" (non-civil engineering, agronomy, economics,

etc.) from the more "traditional" categories of law, philosophy and civil engineering.

	No. enrolled		Index		% of total	
	1953	1964	1953	1964	1953	1964
Traditional(1)	45,638	88,502	100	194	83.8	67.9
Modern(2)	8,830	41,816	100	474	16.2	32.1

Source: Saunders, op. cit., p. 138, Table VII.

Notes: (1)Traditional professions: Philosophy, science, letters, law, civil engineering and dentistry.

(2)Modern professions: Non-civil engineering, economics, agronomy, social work, administration and architecture.

[6]John C. Shearer, High Level Manpower in Overseas Subsidiaries: Experience in Brazil and Mexico (Princeton, N. J.: Industrial Relations Section, Princeton University, 1960).

[7]Ibid., p. 93.

[8]Very limited facilities for developing and training management personnel exist in Brazil. The most extensive program in business administration on both undergraduate and graduate level is conducted by the School of Business Administration of Sao Paulo. Three times a year this school provides a thirteen-week course in advanced management as well as certain extension services.
See: Shearer, op. cit., pp. 107-08.

[9]The 21 U. S. subsidiaries in Brazil are distributed as follows: Chemicals 4; Machinery (non-electrical 2; Electrical machinery 3; Transport equipment 2; thus, about one-half are in these four "modern" activities.
See: Ibid., Appendix B, p. 147, Table B-2.

[10]Enrollments in Brazil's primary schools doubled between 1948 and 1961. Yet in 1962 Brazil ranked lowest among LAFTA countries in the number of people enrolled in primary school per 1000 population and as a percentage of primary school age group. See: Table B.2, p. 249.
As an additional comparison we present data on public expenditure on education in Brazil and other Latin American as well as selected industrial countries. See: Table B.3, p. 250.

TABLE B.2.--Primary education enrollment in Brazil and other LAFTA countries, 1962.

Country	No. enrolled (thousands)	Enrollment per 1000 of population	Rank	Enrollment as a % of age group 7-12	Rank
Argentina	3,056	143	5	114	2
Brazil	7,846	106	9	72	9
Chile	1,274	159	2	107	4
Columbia	1,904	116	8	73	8
Ecuador	642	140	6	87	6
Mexico	5,620	146	4	92	5
Paraguay	323	174	1	120	1
Peru	1,562	147	3	88	7
Uruguay	343	118	7	112	3

Source: Sylvian Lourie, "Education for Today or Yesterday," Problems and Strategies of Educational Planning, ed. by Raymond F. Lyons (Geneva: UNESCO, 1965), pp. 28-44, Table VI.

TABLE B.3.--Public expenditure on education in Brazil, LAFTA countries and selected industrial countries--1960.

Country	Public expenditure on education (mill. $)	Per capita public expenditure ($)	Rank	Public expenditure on education as a % of GNP	Rank
Argentina	182.6	8.83	2	1.9	5
Brazil	250.5	3.59	7	2.1	4
Chile	121.9	15.85	1	2.8	1
Colombia	68.0	4.41	6	1.9	6
Ecuador	12.3	2.85	8	1.6	8
Mexico	207.6	5.76	4	1.9	7
Paraguay	3.5	2.00	9	1.5	9
Peru	51.9	5.18	5	2.6	2
Uruguay	24.7	8.73	3	2.3	3
SELECTED INDUSTRIAL COUNTRIES					
U.S.-1961	23,000	125.0		4.40	
Canada-1960	1,670	93.3		4.38	
United Kingdom-1961	3,267	61.65		4.25	
Germany-1961	2,337	41.59		2.86	
France-1960	1,460	31.95		2.42	

Source: Sylvian Lourie, "Education for Today or Yesterday," in Problems and Strategies of Educational Planning, ed. by Raymond F. Lyons (Geneva: UNESCO, 1965), pp. 28-44, Table VI.

[11] Leff, Brazilian Capital Goods . . ., op. cit., p. 69.

[12] Ibid., p. 70.

[13] A. B. Araoz, "Manpower and Employment in Brazil," International Labour Review, XCIII (April, 1966), 382.

[14] Havighurst and Moreira, Society and Education in Brazil (Pittsburgh: University of Pittsburgh Press, 1965), p. 205, Table 33.

[15] Automotive executives in Brazil estimated that within a few years their industry alone will need five or six times the number of technical personnel now trained annually in Brazil. See: Shearer, op. cit., p. 94.

[16] ECLA, The Manufacture of Industrial Machinery and Equipment in Latin America: I, Basic Equipment in Brazil (New York: United Nations, 1963), p. 60.

[17] M. E. Kreinin, "Comparative Labor Effectiveness and the Leontief Scarce-Factor Paradox," American Economic Review, LV (March, 1965), 131-40.

[18] Ibid., 137, Table 3.

[19] Ibid., 137, Table 4

[20] ECLA, The Textile Industry in Latin America: II, Brazil (New York: United Nations, 1963).

[21] Ibid., p. 83.

APPENDIX C

THE INSTITUTIONAL SETTING OF WAGE DETERMINATION IN BRAZIL

Labor Unions

Based on the limited evidence available, I concluded that labor unions in Brazil occupy a weak bargaining position.[1] In Brazil, labor unions have a legal status which is bestowed on them by the state upon fulfillment of certain specified conditions. Most matters that are subject to collective bargaining in the United States are regulated by law in Brazil. The tradition of paternalism in the relation between the state and the unions was shaped in the 1930's through the policies of the Vargas dictatorship. The end result is that trade union activities are closely regulated by the government, which controls the chartering of Sindicatos and Federations, approves candidates for union elections, interprets their by-laws and audits their income and expenditures.[2]

Briefly, the organization of the labor unions can be described as follows. At the lowest level of the organizational structure are the Sindicatos, which are formed by workers in a single industry in a given locality. Next in the union hierarchy are the Federations, which are composed of a minimum of five sindicatos representing workers in related industries. At the top of the labor union's hierarchy are the Confederations, composed of a minimum of three federations set up on the federal level. One of the four existing Confederations is the National Confederation of Industrial Workers (CNTI), whose membership is claimed to be two million but is estimated to be in fact at three-fourths of one million.

The unions bargain for "better working conditions," which is interpreted to mean higher wages since fringe benefits are provided for by government legislation. Labor contracts that govern wages are usually negotiated by corresponding workers' and employers' organizations. However, in practice most industrial disputes are settled through an intricate system of labor courts rather than by collective bargaining. This led Alexander to remark that in Brazil: "The labor court system thus largely takes the place of both collective contract negotiations and grievance procedure as practiced in the United States."[3] The threat of striking and the act of strike itself, the most potent weapons available to labor unions in industrial countries, have not been nearly as effective in Brazil.[4] Thus, given the structure of Brazilian labor unions, their limited scope for collective bargaining and the largely inactive union membership; their effect on wages cannot be considered critical.

Some Institutional Characteristics of Wages in Brazil

The Brazilian Constitution guarantees a minimum wage defined as a payment sufficient to meet the "normal needs" of a worker for board, lodging, clothing, hygiene and transportation. Changes in the minimum wage rates are based on cost-of-living studies made in 53 regions of the country. As a result, the minimum wage varies from one part of the country to the other. In 1956 the minimum wage ranged from 3,200 cruzeiros per month in Rio de Janeiro and Sao Paulo to 1,300 cruzeiros a month in the cities of the Amazon Valley.[5]

There are two additional aspects of the minimum wage worth noting. In the first place, wage scales for skilled and semi-skilled workers lie considerably above the minimum although they tend to rise when the minimum wage is being adjusted.[6] This can be seen in Table C.1.

TABLE C.1.--Monthly salaries and wages paid by United States companies in Sao Paulo, first quarter, 1957 (in cruzeiros).

	Low	Average	High
Unskilled worker	3,690	4,230	4,640
Skilled worker	4,490	6,560	9,040

Source: Adapted from W. B. Dale, Brazil/Factors Affecting Foreign Investment (Menlo Park, Calif.: International Industrial Development Center, Stanford Research Institute, September, 1958), p. 65, Table 60.

When reading Table C.1, it is important to bear in mind that the legal minimum wage during the first quarter of 1957 in Sao Paulo was 3,700 cruzeiros a month. Thus, if one may generalize from Table C.1, it appears that wages paid by Brazilian industries run considerably ahead of the legal minimum. More recent evidence, based on a broad segment of economic activity, confirms these findings. Based on it, even the lowest paid industrial workers received earnings above the legal minimum wage of 44,000 cruzeiros per month (in 1966). In fact, the average wages of unskilled workers in all activities were about fifteen per cent above the legal minimum wage.[7]

The industrial sector of the city of Sao Paulo in 1966 reported that about 15 per cent of all employees earned less than the legal minimum wage. There are considerable differences among industries in the ratio of employees who are at or below the legal minimum. In the traditionally low wage industries, like textiles and clothing, the proportion of workers earning the minimum was higher than the average; about 32 per cent in Sao Paulo and about 38 per cent in the State of Guanabara. In the more "dynamic" industries like transportation equipment, chemicals and machinery, only about 12 per cent of the employees received the legal minimum or below. Thus, it seems that the effect of increases in the minimum wage on inter-industry earnings would largely depend on the skill characteristics of the industry involved.[8]

Given the continuous shortage of skilled labor in Brazil, labor market pressures force the employer to maintain the real income of his employees by periodical adjustment in their money wages.[9]

One other important feature of a wage structure is the number and relative size of the components into which total earnings are divided. In Brazil there exists a considerable body of social legislation that provides for such fringe benefits as paid vacations, partly paid sick leave, accident insurance and retirement pensions. In addition to the payment for actual hours worked, employees receive remunerations that are equivalent to a day's pay for the following: Sundays, twenty days annual vacation, average of ten holidays, and fifteen days of annual sick leave. Dale estimated that these non-wage labor costs amount to about 40 per cent of total wages for unskilled workers and about 20 per cent for employees in higher wage brackets.[10]

Another characteristic of the wage structure of a country is the wage differentials based on the skill requirements of a job. The general tendency in Brazil was for percentage differentials between wages of skilled and unskilled labor to narrow (see Table C.2). The reader must be cautioned that Table C.2 is based on a very limited sample, i.e., the reports of United States companies in the Sao Paulo area. The conditions in that area

TABLE C.2.--Average monthly wage and salaries paid by United States companies in Sao Paulo (in cruzeiros), 1951, 1957 and 1959.

Type of labor	1952	1st quarter 1957	June 1959
Skilled worker	2,630	6,560	9,583
Unskilled worker	1,500	4,230	6,894
Differential between skilled and unskilled wages	1,130	2,330	6,894
Percentage by which the skilled wage exceeds the unskilled wage	75	55	39

Source: Adapted from Gordon and Grommers, U. S. Manufacturing Investment in Brazil (Cambridge, Mass.: Harvard University Press, 1962), p. 119, Table 18.

may not be representative of most other parts of the country. Generally it seems reasonable to assume that the supply of skilled labor is considerably tighter in the less developed parts of Brazil (e.g., the Northeast) compared to the Sao Paulo industrial enclave.

Furthermore, while the differentials between skilled and unskilled workers' earnings were declining when expressed in percentages, the absolute difference between the two was increasing. An explanation of this discrepancy may lie in the theory of investment in human capital.[11] Specifically, the widening of the absolute wage differential between skilled and unskilled labor should stimulate investment by workers in their own training, increasing thereby the supply of skilled labor relative to unskilled labor. Assuming that no change took place in the relative demand for labor between the two groups, the upward bias in the supply of skilled labor would have a persistent narrowing influence on the percentage differential. The evidence for several industrial countries points in the direction of decreasing occupational wage differentials, but for Brazil this conclusion must be qualified in the absence of additional evidence.[12]

FOOTNOTES: APPENDIX C

[1] Most of the following discussion of labor unions in Brazil is based on two sources: Robert J. Alexander, Labor Relations in Argentina, Brazil, and Chile (New York: McGraw Hill Co., 1962); and Dale, op. cit.

[2] Alexander captured this reality in the following passage: "The freedom of action of both workers' and employers' organizations is seriously impeded. The experience of the corporate state has left the government with a very large degree of control over the contacts between employers and their workers, a control which is exercised through the Ministry of Labor and the labor court system." Alexander, op. cit., p. 87.

[3] Ibid., p. 98.

[4] As Alexander noted: "Strikes have not strengthened the union's position and the number of collective contracts has been extremely limited. Even in cases where collective agreements are signed, they usually concern things which would otherwise be settled by dissidios colectivos--that is, wages and other monetary fringe benefits. There are few contracts of the sort which have become customary in the United States--documents ranging over the whole field of relations between the workers and the employer." Ibid., p. 94.

[5] Ibid., pp. 125-26, Table 6.

[6] Gordon and Grommers, op. cit., p. 118.

[7] See Table C.3, p. 260.

[8] Detailed evidence on this point is found in P. Gregory, "Evolution of Industrial Wages and Wage Policy in Brazil 1959-67," USAID/Brazil (September, 1968), Table 6.

[9] In addition, at times the increases in the minimum wage were illusory. In anticipation of wage increases businessmen would boost prices by more than their normal mark-up. This would have the effect of offsetting partially or completely any rise in workers' minimum wages when they were finally ordered. See: Alexander, op. cit., p. 125.

TABLE C.3.--Average monthly wage in Rio de Janeiro, according to activity and employees function, April, 1966 (1,000 cruzeiros).

Branch of activity	Administrators	Office personnel	Sales personnel	Various other functions	Unskilled workers
Industry	100.3	111.5	79.9	58.0	51.2
Commerce	205.3	84.5	71.9	53.1	46.8
Credit enterprises	305.8	127.3	45.0	66.8	66.4
Land transportation	123.3	63.3	n.a.	53.8	45.0
Education, culture, communications and publicity	348.3	90.7	196.7	79.8	49.2
All activities	198.4	102.8	73.6	58.3	50.6

Source: Lee, "Brazilian Exports of Manufactured Goods," Conjuctura Economica, XIII (May, 1966), 44, Table VI.

[10] Dale, op. cit., p. 125.

[11] See: Becker, op. cit., 66.

[12] This tendency has been observed by Rothbaum for the United States, France and Italy. See: Melvin Rothbaum, "An Interpretation of Wage Structure Changes in France, Italy and the United States from 1938 to 1952" (unpublished Ph. D. dissertation, Harvard University, 1952).

APPENDIX D

DATA APPENDIX

TABLE D.1.--Exports of Brazil based on SITC (revised) classification, various years (in millions of dollars).

Commodities by SITC classifications	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Fruit & Vegetables 05(051,055...)	27.08	34.17	40.16	34.83	32.08	31.39	22.18	30.72	31.68	20.98	22.97	29.61	39.24	41.27
Sugar & Honey 061	22.41	12.38	46.91	1.60	45.87	57.37	42.77	57.97	65.61	39.50	72.89	33.14	56.73	80.53
Coffee 071	1088.27	948.08	843.94	1029.78	846.56	687.51	733.04	712.71	710.39	642.67	748.28	759.91	707.39	773.53
Cocoa 072	90.60	147.47	102.86	78.34	91.24	105.06	84.90	93.82	60.86	41.07	50.82	45.76	41.08	71.67
Hides, Skins, undressed 211	13.38	10.55	9.10	9.46	9.33	9.69	15.66	13.08	11.04	8.57	7.70	10.37	18.86	21.60
Oil Seeds, Nuts, Kernels 221	6.12	8.74	13.05	7.01	10.02	7.13	6.02	.21	7.76	15.44	8.71	.28	12.43	16.77
Lumber Shaped Conifer 243.2	40.30	39.34	58.42	33.64	64.15	51.77	38.16	42.72	47.65	38.64	35.83	47.62	52.89	56.20
Cotton 263	101.76	223.12	136.08	90.37	46.79	25.54	36.59	47.79	112.57	115.08	117.64	111.31	97.66	112.96
Non-manufactured Textiles & their waste 26	130.11	246.98	156.65	115.77	71.19	40.88	64.11	71.68	137.70	140.31	154.35	172.81	138.18	163.08
Iron Ore, Concentrates 281	22.82	21.58	29.97	35.14	29.97	35.14	43.70	53.64	60.14	69.49	70.92	80.64	102.98	100.20
Non-ferrous base Metal Ore, conc. 281	10.98	5.28	9.09	13.37	41.38	34.15	33.44	33.79	34.90	30.51	27.26	21.80	33.60	33.90
281 & 283	33.80	26.86	39.06	48.51	71.35	69.29	77.14	87.43	95.04	100.00	98.18	102.44	136.58	134.10
∑(1) + (2)...(11)	1452.07	1474.57	1310.15	1358.94	1241.79	1060.09	1083.98	1110.34	1167.73	1047.18	1199.73	1201.94	1203.38	1358.75
Food & Live Animals 0	1243.28	1160.61	1064.33	1182.09	1046.33	944.85	968.53	936.89	934.57	791.73	968.22	920.92	988.35	1121.76
Beverages & Tobacco 1	16.52	18.45	18.53	20.53	17.70	17.13	15.64	19.00	27.10	24.02	24.54	29.43	26.87	23.33
Crude Materials excl. Fuels 2	236.51	343.45	288.32	224.39	256.68	192.37	211.80	227.59	319.69	318.90	322.23	355.56	398.43	428.87
Mineral Fuels,etc. 3	.01	.00	.02	.02	2.82	21.21	28.97	12.81	23.36	7.43	9.42	2.66	.01	.00
Animal Vegetable Oil, Fat 4	29.38	23.06	25.14	26.07	39.52	35.08	23.35	31.30	43.46	32.79	35.90	40.13	46.72	38.31
Chemicals 5	7.87	6.78	10.37	7.92	7.44	7.42	8.08	13.38	20.00	14.77	16.60	17.65	14.53	26.84
Iron & Steel 681,672,673,674	n.a.	n.a.	2.41	6.01	4.42	.31	.21	2.72	2.91	1.21	3.24	17.19	43.95	19.40
Basic Manufactures 6	2.26	2.55	6.44	10.31	8.79	6.80	7.44	12.47	10.33	9.46	13.34	38.77	77.83	60.99
Machines, Transport Equipment 7	.39	1.54	2.91	2.10	1.45	1.86	2.15	2.00	11.26	12.02	10.63	18.27	28.88	33.31
Misc. Manufactured Goods 8	.23	.34	.35	.93	.48	.40	.45	.74	1.14	.93	1.41	1.66	2.98	3.70
Goods not classed by kind 9	2.86	5.05	6.84	7.63	10.39	10.88	10.55	12.61	12.06	2.13	3.45	4.75	10.84	4.39
0 + 1 + 2 + 3	1496.32	1522.51	1371.20	1427.03	1323.53	1180.56	1224.94	1196.29	1304.72	1142.08	1324.41	1308.57	1413.66	1573.96
6 + 7	2.65	3.09	9.35	12.41	10.24	8.66	9.59	14.47	21.50	21.48	23.97	57.04	106.71	94.30
5 + 6 + 7 + 8	10.75	10.21	20.07	21.26	18.16	16.48	18.12	28.59	42.73	37.18	41.98	75.35	124.22	124.84
Total Exports	1539.32	1561.84	1423.25	1482.02	1391.61	1242.98	1281.97	1268.80	1402.97	1214.19	1406.48	1429.79	1595.48	1741.44
Total Exports--Coffee [(28) - (3)]	451.05	613.76	579.31	452.24	545.05	555.47	548.93	556.09	692.58	571.52	658.20	669.88	888.09	967.91

Source: United Nations, Yearbook of International Trade Statistics, 1956, 1961, 1964, 1966 (New York: United Nations, 1957, 1963, 1966, 1968).

TABLE D.2.--Imports of Brazil based on SITC (revised) classification, various years (in millions of dollars).

Commodities by SITC classifications	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Cereals & Preparations 041,046,048	196.80	164.61	172.64	125.98	116.76	125.41	141.29	151.00	146.96	170.64	173.56	218.45	144.00	181.66
Fruit & Vegetables 05	40.03	31.89	30.31	18.82	20.85	11.21	14.61	15.62	18.05	29.09	33.11	29.00	27.58	37.08
Food & Live Animals 0	280.06	237.59	141.76	189.57	176.56	156.91	172.81	189.39	193.40	230.60	246.88	286.44	202.48	263.74
Beverages & Tobacco 1	3.74	3.07	1.52	2.41	2.34	2.24	2.47	2.86	2.73	2.56	2.73	1.72	1.01	1.47
Rubber, Crude Synthetic 231	.18	11.04	18.65	4.74	10.62	13.46	23.45	31.88	24.99	22.34	19.15	13.79	7.82	3.61
Pulp & Waste Paper 251	15.93	31.63	23.08	22.59	24.63	16.24	15.17	12.87	12.40	9.78	8.74	5.36	3.61	7.63
Non-manufactured Textiles and their Waste 26	3.31	3.23	2.09	5.64	2.30	2.18	1.65	3.20	4.50	6.98	10.65	4.11	3.23	3.54
Crude Fertilizers & Minerals excl. Coal,Pet.,& Prec. Stones 27	16.72	15.14	11.35	13.22	14.09	11.81	11.11	11.18	13.74	13.20	15.98	14.17	20.12	21.05
Crude Materials excl. Fuels 2	39.82	69.20	63.98	56.82	61.85	47.49	58.25	68.35	64.43	62.70	67.30	44.74	43.41	53.06
Crude Petroleum 331	.98	3.78	77.07	106.07	116.68	133.27	122.68	112.63	137.64	174.20	176.36	170.37	156.44	164.57
Petroleum Products 332	235.20	256.93	177.13	177.70	149.38	147.86	129.53	138.23	104.03	56.03	54.74	44.61	702.59	742.65
Petroleum + Products 33	236.18	260.71	254.20	283.77	266.06	281.13	252.21	250.86	241.67	230.23	231.10	214.98	193.24	206.38
Mineral Fuels 3	255.76	282.66	281.43	307.87	290.03	297.62	272.39	281.41	267.80	262.60	262.36	258.11	225.36	251.66
Animal, Vegetable Oil, Fat 4	5.63	12.37	8.27	3.56	15.42	5.14	5.12	7.33	5.44	8.85	6.96	16.38	13.76	16.15
Chemical Elements & Compounds 51	35.49	78.86	55.56	74.31	62.36	56.65	58.38	63.18	58.99	69.45	n.a.	n.a.	77.84	102.76
Dyeing, Tanning & Colouring Mats. 53	5.81	21.51	7.97	9.30	6.33	6.59	6.93	6.98	9.38	9.82	10.27	9.58	8.84	11.92
Medicinal, etc. Products 541	17.11	28.11	16.43	15.30	18.64	16.01	10.15	10.95	10.34	11.35	10.90	9.49	10.60	14.88
Fertilizers Manufactured 561	9.53	11.43	16.19	19.14	25.85	25.72	15.46	23.79	19.47	17.12	23.86	19.19	26.39	26.01
Chemicals 5	85.52	172.78	120.21	145.34	144.30	132.04	117.29	139.69	145.66	162.45	179.47	148.13	174.16	226.13
Paper & Paperboard 641	22.59	30.11	30.95	36.24	46.21	36.59	33.58	36.54	32.30	26.65	26.05	16.35	13.40	15.81
Textile Yarn, Fabrics, made-up Articles & Related Products 65	18.37	23.08	8.98	8.39	7.40	3.18	1.53	1.18	2.38	2.00	2.28	1.53	1.28	1.38

Non-metallic Mineral Manufactures N.E.S 66	36.50	19.87	6.79	1.22	.64	.33	1.09	.23	13.92	12.79	14.05	10.37	10.45	15.41
Iron & Steel 681,672,673,674	50.92	109.36	67.81	48.18	80.75	43.19	86.30	82.42	64.86	50.59	87.13	51.82	47.67	27.06
Non-ferrous Metals 68	43.55	67.55	31.01	46.07	42.58	32.37	28.28	41.32	50.54	58.48	68.04	50.20	56.39	112.97
Manufactures of Metal N.E.S. 69	28.22	47.89	31.52	36.48	36.81	29.31	50.63	43.73	50.08	44.93	40.91	28.78	23.40	31.42
Basic Manufactures 6	209.76	311.11	196.18	195.12	233.63	160.19	217.21	222.78	217.62	198.57	242.00	162.01	155.68	249.14
Power Machinery non-electric 711	26.39	35.27	26.60	25.00	36.38	33.02	29.97	32.77	39.39	37.05	41.92	26.16	28.77	32.32
Agricultural Machinery 712	3.96	20.28	7.23	8.11	10.26	6.04	3.59	5.88	42.71	8.00	9.74	8.30	3.52	7.42
Office Machines 714	3.68	9.84	5.37	5.18	9.65	11.07	8.65	9.65	16.38	16.28	16.89	14.81	15.94	23.02
Metal-working Machinery 715	21.13	24.53	21.48	17.10	32.22	45.05	78.38	53.93	55.48	75.08	38.72	32.28	21.08	30.95
Electrical Machinery Apparatus & Appliances 72	63.72	79.86	59.13	52.33	62.09	63.60	71.50	58.22	100.10	94.34	82.06	61.21	50.54	81.60
Railway Vehicles 731	37.59	17.72	20.05	20.05	47.53	44.41	30.78	20.82	28.70	36.91	21.80	17.62	6.05	8.88
Road Motor Vehicles 732	61.61	87.65	45.76	55.04	104.12	122.79	109.78	85.75	25.19	36.10	30.74	24.59	27.74	53.21
Aircraft 734	13.31	12.58	18.82	9.94	31.35	26.84	19.81	32.54	28.05	25.50	46.07	14.21	8.71	16.93
Machines, Transport Equipment 7	409.61	497.26	360.27	309.75	525.19	519.71	502.90	521.55	523.06	507.75	436.45	308.73	244.30	381.28
Instruments, Apparatus 861	6.89	13.63	10.54	8.74	12.77	12.98	10.59	11.83	16.79	16.41	17.92	14.26	11.81	20.19
Photographic & Cinematographic Supplies 862	4.26	5.80	4.43	4.46	5.58	4.77	4.62	4.86	5.94	6.69	6.45	6.05	6.40	8.41
Printed Matter 892	9.34	12.96	12.09	11.15	10.90	8.78	7.43	7.59	7.61	6.92	8.49	9.24	8.46	13.30
Misc. Manufactured Articles 8	25.60	38.68	30.62	27.79	34.25	30.82	25.29	28.06	36.25	36.71	40.16	35.43	33.38	51.26
Commodities & Transactions not classified according to kind 9	2.98	4.70	1.49	1.47	4.37	.71	.73	.70	3.68	2.25	2.51	1.71	2.88	3.31
0 + 1	283.80	240.66	143.28	191.98	178.90	159.15	175.28	192.25	196.13	233.16	249.61	288.16	203.49	265.21
0 + 1 + 2	323.62	309.86	207.26	248.80	240.75	206.64	233.53	260.60	260.56	295.86	316.91	332.90	246.90	317.27
0 + 1 + 2 + 3 + 4	585.01	604.89	496.96	560.23	546.20	509.40	511.04	549.34	533.80	567.31	586.23	607.39	486.02	585.08
7 + 8	435.21	535.94	390.89	337.54	559.44	550.53	528.19	549.61	559.31	544.46	476.61	344.16	277.68	432.54
5 + 6 + 7 + 8	730.49	1019.83	707.38	678.00	937.37	842.76	862.69	912.08	922.59	905.48	898.08	654.30	607.52	907.81
Total Imports	1318.46	1629.44	1305.82	1239.70	1487.99	1352.85	1374.46	1462.12	1460.09	1475.05	1486.85	1263.45	1096.42	1496.21

Source: United Nations, Yearbook of International Trade Statistics 1955, 1958, 1960, 1964, 1966 (New York: United Nations, 1956, 1959, 1962, 1966, 1968).

TABLE D.3.--Exports of Brazil by main areas of destinations, 1953-67 (millions of dollars).

Years	United States and Canada	European Economic Community	Western Europe (incl. United Kingdom)	Japan	1 + 3 + 4	Eastern Europe	Latin America	Other non-industrial countries	Total
	1	2	3	4	5	6	7	8	9
1953	770.0	n.a.	573.5	40.8	1384.3	14.9	110.1	30.0	1539.3
1954	593.6	n.a.	695.0	68.3	1356.9	32.6	145.2	27.0	1561.8
1955	616.7	n.a.	513.9	56.3	1186.8	59.2	146.2	31.1	1423.3
1956	753.0	n.a.	504.2	37.2	1294.4	54.9	102.5	30.8	1482.6
1957	678.0	n.a.	456.0	37.5	1171.5	42.9	143.0	33.9	1391.3
1958	548.0	n.a.	412.4	24.5	984.9	39.8	146.3	72.0	1243.0
1959	608.4	n.a.	380.6	30.8	1019.8	54.5	76.9	130.8	1282.0
1960	580.5	249.1	454.7	31.0	1066.2	72.0	89.0	41.8	1269.0
1961	581.6	313.8	536.7	42.6	1160.9	75.4	97.0	69.7	1403.0
1962	506.7	289.6	482.1	29.1	1017.9	73.2	78.7	44.2	1214.0
1963	553.3	393.7	584.2	31.5	1169.0	92.2	83.7	61.1	1406.0
1964	496.6	373.0	617.7	27.9	1142.2	88.1	139.2	63.5	1433.0
1965	545.1	412.4	673.2	29.9	1248.2	89.0	202.2	55.6	1595.0
1966	604.3	430.6	715.4	41.0	1360.7	104.1	190.7	85.5	1741.0
1967	562.5	452.4	674.8	56.1	1293.4	97.0	188.9	74.7	1654.6

Source: International Monetary Fund and International Bank for Reconstruction and Development, Direction of Trade, Vols. for 1953-67 (Washington, D. C.: IMF, 1953-67).

TABLE D.4.--Imports of Brazil by main areas of origin, 1953-67 (millions of dollars).

Years	United States and Canada 1	European Economic Community 2	Western Europe (incl. United Kingdom) 3	Japan 4	1 + 3 + 4 5	Eastern Europe 6	Latin America 7	Other non-industrial countries 8	Total 9
1953	407.3	n.a.	452.6	11.1	871.0	20.3	304.3	123.2	1318.6
1954	580.7	n.a.	561.4	79.2	1221.3	30.6	235.4	148.3	1630.4
1955	321.2	n.a.	464.7	45.1	831.0	52.9	290.5	134.5	1305.8
1956	364.9	n.a.	386.4	50.0	801.3	66.2	237.1	130.4	1233.8
1957	571.8	257.6	488.5	23.3	1083.6	38.9	236.4	131.5	1483.6
1958	501.1	234.5	410.0	33.3	944.4	28.8	247.4	132.0	1352.9
1959	475.8	258.7	451.2	26.8	953.8	49.2	233.8	135.6	1374.5
1960	459.1	294.3	508.7	38.0	1005.8	82.1	226.4	148.8	1462.0
1961	541.0	262.9	475.1	79.5	1095.6	70.2	146.0	149.8	1460.0
1962	482.2	302.1	501.6	60.2	1044.0	65.1	238.2	128.2	1475.0
1963	481.7	297.2	473.1	61.7	1016.5	75.6	262.4	132.9	1487.4
1964	451.0	210.8	351.2	33.9	836.1	69.3	260.2	100.0	1263.0
1965	338.6	186.8	301.6	36.8	677.0	64.3	272.8	83.4	1096.0
1966	607.4	257.7	422.8	44.5	1074.7	73.1	238.8	110.4	1496.0
1967	590.6	319.7	538.5	50.8	1179.9	79.6	229.7	181.0	1670.2

Source: International Monetary Fund and International Bank for Reconstruction and Development, Direction of Trade, Vols. for 1953-67 (Washington, D. C.: IMF, 1953-67).

TABLE D.5.--Brazil's exports, imports and industry characteristics (1959), various ratios.

Industry group	Exports (1966)	Imports (1966)	Value of sales (1966)	Value added per employee	Horse power per employee (KWH)	Ratio of exports to output	Ratio of imports to value of sales	Skill index II	Skill index III
Transport equipment	11677	188406	2736108	684.0	3.8	.004	.068	2.47	2.80
Rubber	3588	2572	774184	1039.9	7.4	.005	.003	2.05	2.20
Electricity, communications	13642	186451	1749134	496.1	2.6	.007	.106	1.84	2.20
Mechanical	57580	539184	1045789	391.8	2.9	.055	.515	2.00	1.89
Chemicals, pharmaceuticals	49396	501280	4355567	880.9	8.1	.010	.115	1.74	2.20
Editorial & graphic	---	29517	585098	382.2	2.6	.000	.50	1.47	1.60
Plastics	1060	28273	461989	598.1	3.7	.002	.061	1.26	1.60
Metallurgical	44052	404543	3476092	437.6	4.1	.011	.116	1.42	1.40
Miscellaneous	9000	24737	396817	318.5	1.5	.023	.062	1.00	1.20
Perfumes	10148	3936	432903	728.2	2.2	.023	.009	.95	1.20
Tobacco	1463	---	323004	641.1	1.2	.004	.000	1.10	1.40
Furniture	561	---	488079	245.6	2.1	.001	.000	1.00	.60
Paper	301	38019	954788	468.7	8.5	.000	.040	.84	.80
Leather	18651	399	312064	297.6	3.3	.060	.001	.68	.80
Beverages	20312	3214	668101	538.9	4.0	.003	.005	.74	.60
Non-metallic minerals	2530	34132	1347980	270.0	3.2	.001	.025	.58	.60
Textiles	33807	2937	3614841	224.8	2.5	.009	.000	.63	.40
Clothing	886	---	969459	238.4	.6	.001	.000	.58	.40
Food	126176	80958	6095654	459.0	5.5	.020	.013	.58	.40
Lumber	152207	248	606032	251.3	4.5	.248	.000	.47	.20

Source: For exports and imports see sources for Table D.1 and D.2.
Industry characteristics for 1959 are from: IBGE, Servico Nacional de Recenseamento, Censo Industrial de 1960, Serie Nacional, Vol. III.

TABLE D.6.--Wages, value added, and other industry statistics (in thousand cruzeiros), 20 industries, protection 1958 (in per cent).

Industry	Average annual earnings	Value added per product-workers man-year	Ratio of wage cost to value added	Non-wage value added per unit of output	Non-wage value added per product worker man-year	Value of output per production worker man-year	Gross capital assets per production worker man-year	Horse power per production worker man-year	Skill ratio II	Skill ratio III	Average nominal tariff	Average total protection
	1959	1958	1959	1959	1958	1959	1959	1959				
Transformation industry	72.7	250.0	.18	.34	175.5	849.1	272.5	3.7	1.00	1.00	n.a.	n.a.
Food products	60.7	311.3	.13	.25	242.9	1469.0	355.4	5.5	1.49	1.30	76	62
Chemicals & pharmaceuticals	92.1	595.7	.104	n.a.	477.9	1888.3	613.7	8.1	2.19	2.25	45	30
Tobacco	71.5	485.8	.11	.45	405.9	1197.0	211.7	1.2	.32	.77	187	290
Textiles	63.7	143.9	.29	.30	89.1	498.3	165.4	2.5	.68	.61	175	355
Clothing, footware & cloth articles	62.9	153.6	.27	.33	95.5	491.1	75.9	.6	.16	.28	220	316
Lumber	58.3	155.5	.23	.40	105.3	448.1	129.6	4.5	1.22	.69	39	28
Furniture	69.7	170.5	.28	.35	[illegible]	446.6	119.5	2.1	.57	.40	[illegible]	215
Paper & cardboard	76.5	278.1	.16	.35	202.6	1025.4	301.0	8.5	2.30	1.10	87	96
Editorial & graphic	88.5	256.4	.23	.39	145.0	626.8	244.1	1.3	.35	.90	116	124
Rubber	88.5	366.9	.09	.45	271.2	1940.6	431.6	7.4	2.00	1.58	95	117
Furs, leather & similar products	65.6	183.1	.22	.33	122.6	643.6	184.9	3.3	.89	.68	102	96
Non-metallic minerals	59.1	196.1	.22	.48	134.9	405.3	195.2	3.2	.86	.68	73	70
Metallurgic	89.5	286.0	.20	.38	196.9	845.3	307.4	4.1	1.11	1.13	48	39
Mechanical	91.9	233.0	.23	.36	141.5	694.6	364.5	2.9	.78	1.34	42	24
Electricity & communications	87.0	351.2	.18	.33	245.6	1066.6	321.3	2.6	.70	1.18	108	187
Transportation materials	100.2	393.2	.15	.40	282.4	1315.0	621.8	3.8	1.03	2.28	102	129
Miscellaneous	72.5	215.7	.23	.42	140.8	509.2	136.1	1.5	.40	.50	98	110
Beverages	73.2	362.1	.14	.42	264.1	963.8	443.0	4.0	1.08	1.63	199	413
Perfumes, soaps & candles	61.1	n.a.	.08	n.a.	n.a.	n.a.	292.6	2.2	.59	1.07	186	127
Plastic materials	77.7	n.a.	.14	n.a.	n.a.	n.a.	293.1	3.7	1.00	1.08	116	162

Source: For 1959, IBGE, Servico Nacional de Recenseamento, Censo Industrial de 1960, Serie Nacional, Vol. III.
For 1958, IBGE, Conselho Nacional de Estatistica Produção Industrial Brasileira 1958, Rio de Janeiro, December, 1960.

TABLE D.7.--Wages, value added and other industry statistics (in thousand cruzeiros), protection (in per cent).

Industry	Average annual earnings		Value added per production worker man-year		Non-wage value added per production worker man-year		Ratio of wage cost to value added	Non-wage value added per unit of output	Horse power per product-worker man-year	Protection (1958)			
	1958	1959	1958	1959	1958	1959	1959	1959	1959	Simple average tariff	Weighted average tariff	Exchange premiums & simple average tariff	Exchange premiums & weighted average tariff
Editing and printing of texts	76.1	89.1	281.9	307.9	163.5	192.3	.30	.45	.78	5.0	5.	33.8	33.8
Other graphic services	79.0	92.1	265.8	443.3	162.8	309.3	.21	.41	1.28	49.0	85.	66.3	92.8
Printing of commercial & scholastic materials	59.3	72.8	164.5	262.5	86.0	166.4	.28	.33	1.16	.0	0.	78.4	78.4
Editing & printing of other periodicals	106.1	112.1	404.0	446.0	252.9	270.9	.27	.43	1.59	.0	0.	30.1	30.1
Editing & printing of newspapers	91.7	98.5	393.9	602.9	221.5	391.7	.16	.46	1.59	.0	.0	30.1	30.1
Calcium oxide	37.2	37.0	129.0	151.8	83.1	109.0	.24	.46	.65	40.0	40.	129.5	129.5
Pieces, ornaments & structures of cement, plastic & fibrous cement	50.0	65.1	242.5	313.4	171.0	221.0	.21	.39	1.86	80.0	80.	260.1	260.1
Other products & finishing of non-metallic minerals	50.4	63.7	233.9	298.0	157.3	212.6	.21	.42	2.78	102.0	97.	276.4	272.7
Ceramic material	47.8	60.9	164.1	218.3	104.4	140.5	.28	.47	2.44	77.0	87.	257.9	265.3
Cement	58.0	70.2	571.1	888.2	489.7	781.3	.08	.55	17.95	54.0	54.	139.8	139.8
Glass, glassware & crystal ware	58.8	76.0	241.1	339.6	161.1	227.1	.22	.39	2.79	71.0	88.	152.4	164.9
Combined articles of paperboard	50.8	67.0	202.7	289.3	138.7	203.8	.23	.33	n.a.	79.0	98.	158.3	172.3
Paper, cardboard preparation	61.6	75.6	265.3	481.5	177.4	378.2	.16	.37	10.71	61.0	46.	145.0	133.9
Machinery for agriculture & rural industry	55.9	70.1	198.6	285.1	126.0	190.4	.25	.36	2.43	33.0	30.	124.4	122.1
Electrical apparatus	71.4	84.5	378.9	476.9	261.5	325.1	.18	.31	2.31	94.0	69.	169.4	150.9
Electrical material	67.1	85.6	320.0	455.9	217.4	324.4	.19	.32	3.32	66.0	68.	148.7	150.2
Bodies for motor vehicles	69.1	87.1	263.8	373.0	172.3	255.2	.23	.34	2.57	120.0	120.	188.6	188.6
Vehicles to be pulled by animals	41.6	38.7	101.6	169.4	43.7	119.6	.23	.34	3.03	80.0	80.	159.0	159.0
Construction & repair of aircraft	86.5	79.4	195.3	195.7	83.7	79.8	.41	.27	.72	5.4	2.	101.5	101.5
Fabrication of motor vehicles, pieces & engines	78.0	96.6	569.7	883.5	434.6	709.9	.11	.41	4.40	157.0	72.	164.2	153.1
Construction & repair of vessels	111.0	116.7	119.3	231.9	61.3	81.1	.50	.21	1.55	2.0	n.a.	101.5	n.a.
Dairy products	45.7	60.7	434.7	602.5	357.6	509.7	.10	.24	4.39	208.0	71.	250.5	253.5
Fish preserves	33.2	46.0	155.3	223.5	114.6	166.1	.21	.32	1.10	278.6	107.	286.7	200.1

Preserves of fruits & vegetables, spices & veg. conditioners	36.4	45.0	257.7	295.1	204.9	228.3	.15	.31	1.86	112.0	113.	283.8	284.5
Animals fats, preserves of meat & pork fat	50.6	64.0	230.0	379.5	160.6	297.4	.17	.19	3.09	107.0	110.	280.1	282.3
Sugar	41.6	59.8	242.6	379.6	185.1	291.3	.16	.32	7.90	74.0	80.	255.7	260.1
Fabrication of hats	52.2	57.5	189.0	255.0	110.0	178.4	.23	.41	1.60	120.0	120.	289.7	289.7
Fabrication of shoes excl. rubber shoes	47.3	59.8	147.5	207.1	91.9	136.3	.29	.35	.64	120.0	120.	289.7	289.7
Accessories of clothing	47.3	64.9	170.6	290.4	108.6	207.9	.22	.32	.43	120.0	120.	289.7	289.7
Weaving of wool	58.6	72.3	181.0	194.3	110.5	110.7	.37	.28	2.92	87.0	66.	265.3	249.8
Weaving of cotton	44.2	59.0	111.7	157.9	62.2	90.3	.37	.30	2.51	106.0	116.	279.3	286.7
Beers	74.7	99.6	471.4	597.8	339.0	435.4	.17	.41	5.53	120.0	120.	289.7	289.7
Distillation of alcohol	43.9	65.1	202.5	493.7	119.6	322.2	.13	.34	9.32	133.0	148.	299.2	310.3
Wines	38.3	42.3	288.1	433.0	228.3	359.0	.10	.36	1.55	143.0	140.	297.0	304.4
Pieces & structures of finished wood	45.9	59.3	146.6	224.7	86.8	151.5	.26	.34	3.66	96.0	104.	271.9	277.8
Other wood artefacts	35.6	54.7	118.6	177.4	73.9	108.2	.31	.37	2.03	n.a.	120.	n.a.	289.7
Preparation of furs & skins	51.5	63.1	203.3	296.0	138.3	213.0	.21	.33	3.77	77.0	58.	257.9	243.9
Furniture (wood, rods, fibers)	52.4	60.1	144.9	194.9	79.7	119.8	.31	.34	2.00	120.0	n.a.	289.7	n.a.
Metal furniture	69.6	87.2	263.8	337.3	171.7	208.2	.26	.34	2.31	70.0	n.a.	252.8	n.a.
Upholstery	55.4	62.7	325.8	356.5	231.5	258.4	.18	.37	.94	120.0	n.a.	289.7	n.a.
Misc. furniture	68.3	80.8	177.7	276.9	96.1	169.3	.29	.32	1.09	120.0	n.a.	289.7	n.a.
Chemicals: elements & compounds	128.8	172.2	562.1	622.6	433.2	450.5	.17	.34	10.20	12.6	21.	112.5	115.5
Plastics & artificial fiber	69.1	93.7	326.1	427.3	233.2	300.6	.22	.33	7.68	40.0	36.	129.5	126.6
Perfumes, soaps & candles	52.5	61.1	478.3	728.8	369.8	606.8	.08	.35	2.00	46.0	40.	235.0	230.6
Disinfectants, insecticides & fungicides	62.8	73.3	533.1	588.5	413.8	446.2	.12	.33	2.48	40.0	51.	129.5	137.6
Oils, waxes, fats excl. nutritious products	40.3	57.2	391.2	575.6	333.3	496.1	.10	.29	5.73	67.0	73.	250.5	255.0
Powders, explosives, matches, firecrackers	45.4	59.1	266.5	254.1	204.8	167.2	.23	.36	1.66	91.0	90.	167.2	166.4
Brushes, brooms, mops	47.2	53.1	148.9	203.8	88.6	134.4	.26	.39	1.16	100.0	107.	274.9	280.1
Jewelry	47.4	58.1	133.7	222.1	70.1	146.8	.26	.40	1.25	81.0	23.	260.9	218.1
Toys & articles for sports & recreation	53.6	69.8	238.4	310.2	172.8	208.9	.22	.40	1.72	116.0	114.	286.7	285.2
Optic & photographic material	66.5	86.2	282.3	324.8	186.0	193.0	.27	.31	2.20	33.0	24.	124.4	117.7
Surgical, orthopedic, dental equipment	56.9	83.1	245.6	547.1	154.9	407.0	.15	.54	1.83	20.0	20.	114.8	114.8
Instruments & articles for professional & technical use & precision measure	66.0	76.4	176.6	280.4	97.5	163.6	.27	.37	n.a.	30.0	32.	122.1	123.6
Musical instruments & records	52.6	67.0	206.8	218.4	139.2	130.0	.31	.43	n.a.	63.0	37.	146.5	127.3
Stamping, production of tin & tubing	60.4	71.2	293.1	314.9	217.2	216.8	.23	.28	1.97	50.0	50.	238.0	238.0
Metallurgy of non-ferrous metals	65.4	80.4	358.8	334.2	260.7	231.6	.24	.31	3.98	56.0	32.	141.3	123.6
Tobacco	35.5	35.5	185.4	162.5	121.6	101.6	.22	.16	.64	126.0	126.	294.1	294.1

Source: For 1959, IBGE, Servico Nacional de Recenseamento, Censo Industrial de 1960, Serie Nacional, Vol. III.
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