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INTERNATIONAL COMPARISONS OF FACTOR INTENSITIES

The Phenomenon of Factor-Intensity Reversals

The evidence for the United States examined in the preceding chapter indicates that value added per employee in manufacturing provides a reasonably good guide to the capital intensity of different industries, reflecting inputs of human as well as physical capital. It may be asked, however, whether any pattern of industries by factor intensity discerned for the United States would hold true for other countries. Doubt on this score is natural, given the lower wage rates and higher capital costs generally prevailing in other countries, especially the less developed ones. All industries will no doubt tend to use more labor in relation to capital in poor, low-wage countries than in richer ones, at least in auxiliary services if not in basic production processes.[1] But if this substitution tendency were stronger in some industries than in others, the ranking of industries by factor intensity would also differ from country to country.[2] And if the tendency were widespread, it would mean that—contrary to the "strong-factor-intensity" hypothesis underlying the factor proportions theorem—one could not confidently rank industries according to their requirements of labor and capital, nor look at the relative factor endowments of different countries for clues to the likely composition and direction of their foreign trade.[3]

[1] In *The Economics of Underdeveloped Countries* (New York, 1966, pp. 188–191), Jagdish Bhagwati gives an illuminating discussion of various ways in which, with a given production process, the amount of labor per unit of capital can be varied.

[2] R. F. Harrod was one of the first, if not the first, to point out the possibility or, as he saw it, the likelihood of this result. See his "Factor-Price Relations under Free Trade," *Economic Journal,* June 1958, pp. 245–255.

[3] For a review of the literature on this subject, see Michael Michaely, "Factor Proportions in International Trade: Current State of the Theory," *Kyklos* XVII, fasc. 4, 1964, pp. 529–550.

Plausibility is added to the notion of factor-intensity reversals by the ready observation that technology seems to be much more fixed in some industries than in others.[4] Thus, the coefficients describing the relative amounts of capital and labor used in making steel or refining petroleum might be rather rigid, but methods of rice production could vary from extremely labor-intensive to highly capital-intensive. With regard to this last example, however, it should also be noted that illustrations of wide variability in factor combinations given in the literature are almost always taken from agriculture and rarely, if ever, from industry.[5]

What was largely regarded as a theoretical curiosity took on new force with the appearance of Leontief's paradox. One way of explaining his results, but one which Leontief himself did not propose, was to accept them as casting doubt on the strong-factor-intensity hypothesis.[6] That is to say, the goods comprising United States imports might be, as ordinarily expected, more labor-intensive than other foreign goods when produced abroad, even though similar ("import-competing") goods produced in this country were found to be relatively capital-intensive in Leontief's analysis.[7]

[4] See, for example, Jack Baranson, "Is There a Direct Route to Development?" *Challenge,* July 1964.

[5] See the cases cited by Charles P. Kindleberger in *Foreign Trade and the National Economy* (New Haven, 1962), p. 76. Lloyd G. Reynolds in a discussion at the 1965 meetings of the American Economic Association made the same point (including, however, the textile industry): "Our examples of labor-using adaptation seem always to come from agriculture, where factor proportions are notoriously flexible, or from textile production" (*American Economic Review,* May 1966, p. 113).

[6] This view is expressed with some emphasis in a note on "The Leontief Paradox" by S. R. Merrett in the *Economic Journal,* September 1965, page 641: "I suggest," he writes, "that Leontief's nonsense conclusion (that America imports capital-intensive goods) derives not from the conjunction of an invalid argument with true premises, but from the conjunction of a valid argument with a false premise. It is a simple and significant proposition that there is more than one way of producing most goods. This . . . is what makes the Heckscher-Ohlin theory almost valueless."

Kindleberger writes in a somewhat similar vein with regard to Leontief's findings: "What he proves is not that the United States is capital-scarce and labor-abundant, but that the Heckscher-Ohlin theorem is wrong." He adds: "When goods change their factor intensities from country to country, depending on factor endowments and factor prices, the Heckscher-Ohlin theorem falls to the ground." (*Foreign Trade and the National Economy,* pp. 75, 76.)

[7] Haberler suggests that the explanation of Leontief's results is that he operates, in fact, not from a two-factor but from a many-factor model. These include not only labor and capital but also various other factors such as "natural resources," "management," and "entrepreneurship," even though these other factors cannot be included, at least so far, in Leontief's statistical measurements. "The existence of factors other than those explicitly treated," Haberler states, "implies that the production functions, *in terms of labor and capital,* are not

Different Elasticities of Substitution

More specific evidence supporting the possibility of factor intensity reversals between countries has been developed by Bagicha S. Minhas, making use of a "Constant Elasticity of Substitution" (CES) production function developed earlier in collaboration with Arrow, Chenery, and Solow.[8] The underlying hypothesis is that, in any given industry, capital would be substituted for labor in a constant relation to increases in the ratio of labor costs to capital costs, but that the rate of substitution would vary from one industry to another depending essentially on the range of technological choices available for combining the two factors. In other words, a higher level of wages in relation to capital costs would always produce some tendency to substitute capital for labor, but at a slower rate in, say, steel than in textiles.

These possibilities are illustrated, in a purely hypothetical manner, in Chart 6. The amount of capital per worker (K/L) is measured on the vertical axis, and the ratio of wages to capital costs (w/r) on the horizontal axis. Both scales being logarithmic, a straight line portrays a constant elasticity of substitution and its slope measures the elasticity. Low elasticities are here assumed for both petroleum refining and leather products, the first remaining strongly capital-intensive and the second strongly labor-intensive throughout. A higher elasticity of substitution is assumed for furniture and a still higher elasticity for food products, the latter ranking lowest in capital intensity in the extreme left area of the chart but even surpassing petroleum refining in the extreme right area.

On the further assumptions indicated in the chart regarding the relative ratios of wages to capital costs in Southern Asia, Japan, Western Europe, and the United States, the ranking of industries in descending order of capital intensity would vary as follows from one area to another:

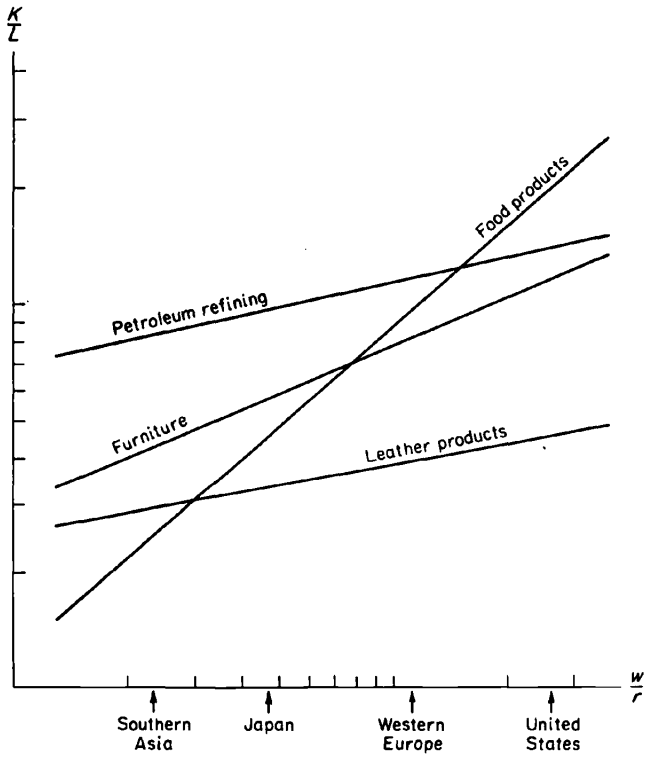
	Southern Asia	*Japan*	*Western Europe*	*United States*
Petroleum refining	1	1	1	2
Furniture	2	2	3	3
Food products	4	3	2	1
Leather products	3	4	4	4

necessarily homogeneous and that the production functions are not the same in different countries" (Gottfried Haberler, *A Survey of International Trade Theory*, Princeton, 1961, pp. 21–22).

[8] *An International Comparison of Factor Costs and Factor Use*, Amsterdam, 1963, and "Capital-Labor Substitution and Economic Efficiency" by K. J. Arrow, H. B. Chenery, B. S. Minhas, and R. M. Solow, *Review of Economics and Statistics*, August 1961.

CHART 6

Hypothetical Illustration of Factor-Intensity Reversals with Constant Elasticity of Substitution Between Capital and Labor



Reasoning from this type of analysis and with estimates of elasticities of substitution developed from international cross-sectional data for a limited number of industries, Minhas states that it is impossible to characterize industries as labor-intensive or capital-intensive without regard to differences in the ratio of wages to capital costs, and further that, in the case of any two industries with different elasticities of substitution, "the reversal of relative factor-intensity is as inevitable as the meeting of two straight lines with different slopes." [9] The only question, he adds, is whether the reversal occurs within the observable range of relative factor prices.

[9] A fuller theoretical analysis of these possibilities is given by Harry G. Johnson, "Factor Endowments, International Trade and Factor Prices," *Manchester School of Economic and Social Studies,* September 1957 (reprinted in Johnson's *International Trade and Economic Growth,* Cambridge, Mass., 1961).

The capstone to Minhas' argument is a comparison of the ranking of twenty industries by capital intensity in the United States and Japan, capital intensity being measured by the stock of fixed capital per worker. If the rankings of industries were not similar between countries, this would indicate that factor-intensity reversals had occurred. The comparison between the United States and Japan is of special interest because of the broad range of industry in the two countries along with wide disparities in the relative amounts and prices of labor and capital. Table 5, reproduced from Minhas' study, shows the rankings of the twenty industries in each country based first on total inputs of capital and labor and then on direct inputs only. The comparison based on total inputs, which Minhas favors, shows a Spearman rank correlation coefficient of only 0.328, far from enough to support the strong factor-intensity hypothesis. The comparison based on direct inputs only yields a much higher coefficient of 0.730, but, he says, sufficiently far from unity "to provide room for reversals in relative capital-intensity to take place" (page 41).

Minhas concludes therefore that the phenomenon of factor reversals is "general enough to be empirically important" (page 40) and "robs the factor proportions theory of any predictive significance in regard to the direction of trade" (page 50). He also makes an "empirical observation" which, if valid, would have major implications for investment policy in less developed countries:

> The observation is that the labor abundant, low wage countries would tend to hold comparative advantage in those industries which have low elasticities of substitution between capital and labor *even though* those very industries happen to be relatively capital-intensive at the prevailing relative cost of labor and capital.[10]

This advice seems to mean that the less developed countries should not hesitate to invest even in very capital-intensive industries, the reason given being that more developed countries "may be able to take advantage of the relative cheapness of capital relatively more in those industries which have higher elasticities of substitution between capital and labor." In terms of the hypothetical examples given in Chart 6 and, presumably, with an eye toward relative wage and capital costs in the distant future, Southern Asia might find it advantageous on Minhas' line of argument to invest in industries typified by petroleum refining, while the United States would do better in those typified by food products.

Since this view has an evident interest for less developed countries

[10] P. 48 (italics in the original).

TABLE 5

Ranking of U.S. and Japanese Industries by Capital Intensity According to B. S. Minhas

Name of Industry	Ranks Based on Total Capital and Labor Requirements		Ranks Based on Direct Capital and Labor Requirements	
	U.S.	Japan	U.S.	Japan
Petroleum products	1	1	1	1
Coal products	2	2	2	2
Agriculture	3	20	3	14
Grain-mill products	4	19	9	6
Processed foods	5	13	10	7
Chemicals	6	5	6	4
Nonferrous metals	7	4	4	3
Iron and steel	8	3	5	5
Paper and products	9	11	7	15
Nonmetallic mineral products	10	9	8	11
Textiles	11	15	18	12
Transport equipment	12	10	11	9
Machinery	13	6	12	10
Rubber and products	14	12	14	16
Shipbuilding	15	7	13	8
Lumber and wood	16	17	15	17
Industry, n.e.c.	17	16	17	20
Printing and publishing	18	8	16	18
Leather	19	18	19	19
Apparel	20	14	20	13

Source: Bagicha Singh Minhas, *An International Comparison of Factor Costs and Factor Use*, Amsterdam, 1963, p. 40.

in search of guiding principles for their investment decisions, it may be useful to consider the reasons for the author's failure to find a stronger relation between the rankings of United States and Japanese industries.

The Natural Resource Factor Again

The unavoidable omission of natural resources from both direct and indirect inputs is no less crucial to Minhas' two-factor model, and to the conclusions drawn from it, than it is to Leontief's. In commentaries published about the same time, Gary Hufbauer and David Ball have challenged the inclusion of agriculture as one of the twenty industries figuring in Minhas' comparison of factor intensities in the United States and Japan (Table 5), given the vastly different endowments of the two countries in farmland.[11] They expressed the same doubts regarding two other industries, grain mill products and processed foods, which also have a high resource content when total (indirect as well as direct) inputs are counted. Omitting all three of these industries, both critics found that the Spearman rank correlation coefficient moved up from only 0.328 to 0.765, based on total factor inputs. The correlation coefficient is further raised to 0.833 if only agriculture is omitted and the calculation is based on direct factor inputs only.

Ball offered a further comparison of capital intensities in United States and Japanese industry on the basis of data given by Arrow, Chenery, Minhas, and Solow in their paper on the "Constant Elasticity of Substitution" production function.[12] He found a rank correlation of 0.603 for all twenty-seven industries covered in the source, including eighteen in manufacturing, six in primary production, and electric power, transport, and trade. As the nonmanufacturing industries were eliminated from the test, the coefficient was progressively raised and, for the eighteen manufacturing industries plus electric power, reached 0.920. These computations were also on the basis of direct inputs.[13]

[11] Hufbauer's criticism is given in an appendix, "Factor Intensity Reversals," to his book *Synthetic Materials and the Theory of International Trade* (Cambridge, Mass., 1966), based on his doctoral dissertation at Cambridge University in 1963. Ball's paper, "Factor-Intensity Reversals in International Comparison of Factor Costs and Factor Use," is in the *Journal of Political Economy*, February 1966. Mention should also be made of a doctoral dissertation by Seiji Naya containing a critical appraisal of Minhas' results ("The Leontief Paradox and the Factor Structure of Japanese Foreign Trade," University of Wisconsin, 1965).

[12] See footnote 8.

[13] Minhas also based his argument in part on fitting the CES production function to selected industries, but these were of illustrative value only and, as Min-

In brief, Hufbauer's and Ball's reappraisal of the data for the United States and Japan indicates that the phenomenon of factor intensity reversals becomes a good deal less common than first appeared, once the comparison is limited to manufacturing industry and based on direct factor inputs only.[14] Their approach, it will be noted, is consistent with that taken here, which will be applied in the next section to other international comparisons on the basis of the value-added criterion.

More recent evidence on the phenomenon of factor-intensity reversals has been presented by Merle Yahr. Using estimates of elasticities of substitution developed from international cross-sectional data for two- and three-digit ISIC industries, she tests directly whether there are significant differences among them, considering each level of industry aggregation separately. The general conclusion that emerges from these tests is that there are no statistically significant differences among the elasticities of substitution.[15]

Problems of International Comparison

For purposes of international comparison, the use of value added per employee as a guide to interindustry variations in capital intensity has the great advantage that the basic data needed are available from censuses of manufactures for a considerable number of countries and frequently for more than one year. Various problems arise, however, in using and interpreting these statistical resources. Those having to do with differences in market forces will first be noted, and then others more specifically concerned with the comparability of the data.

has seemed to recognize, of interest largely because of the "fewness of the cases in which factor-intensity reversals are shown" (Minhas, *Factor Costs and Factor Use*, p. 39). Leontief examined this part of Minhas' analysis in detail and, on the basis of supplemental computations, found that the evidence "does not confirm Minhas' emphatically stated conclusion" against the strong factor-intensity assumption ("An International Comparison of Factor Costs and Factor Use," review article, *American Economic Review*, June 1964, pp. 335–345).

[14] Minhas maintains (p. 41) that "if we restrict attention to direct factor inputs only we no longer remain within the bounds of a two-factor world and all sorts of extraneous things (like differences in the degree of vertical integration among industries) can affect the nature of the results." To the extent that he is right about the effects on the comparability of the data (and other problems in this regard are noted below), the significance of the correlations found would be enhanced.

[15] M. I. Yahr, "Estimating the Elasticity of Substitution From International Manufacturing Census Data" (unpublished Ph.D. dissertation, Department of Economics, Columbia University, 1967), pp. 100–101.

Differing Degrees of Market Freedom

In beginning the analysis of data for the United States in Chapter 2, it was noted that various kinds of interferences with competition in factor and product markets may affect the reliability of value added per employee as a measure of differences among industries in capital intensity. Without implying any normative judgment, there is some reason to suspect that these interferences are stronger in many foreign countries, particularly in some of the less developed countries, than in the United States.

For instance, it is fairly common practice in the less developed countries to provide loans, including loans by international agencies, at preferential rates of interest to industries selected for promotion as compared with the terms available to other borrowers. Such industries may also benefit by accelerated depreciation allowances or other forms of subsidy.

The influence of unionization or, perhaps still more, of minimum wages on the structure of wages across industries and across different groups of the population may be significantly greater in some of the less developed countries than in more advanced ones.

To the extent that, for these or other reasons, factor-price ratios are not the same for all industries in a given country, the ranking of industries by factor intensity would be disturbed compared with that which would otherwise prevail, without thereby constituting genuine cases of factor-intensity reversal.[16] A further difficulty for the value-added criterion in particular is presented by differential monopoly rents in different industries brought about by a combination of controls on new entries or on the expansion of existing enterprises and highly protective tariffs along with quantitative restrictions on imports. These conditions are frequently encountered in less developed countries, whether specifically intended as a form of aid to particular industries or arising out of the scarcity of investment funds and foreign exchange receipts.

[16] In commenting on an early draft of the present study, Jagdish Bhagwati has stressed to the author the likelihood that different industries will, in fact, face different factor-price ratios within the same country, particularly in some of the less developed countries. He has also pointed out in this connection that the fitting of CES production functions to selected industries across countries poses a weaker test of the strong-factor-intensity hypothesis than the correlation method relied on in this study. The first requires only the assumption that firms everywhere will seek to minimize costs. The second requires, in addition, the assumption that factor-price ratios (though differing among countries) are everywhere the same within a given country.

Differences in Statistical Concepts

The concepts employed in censuses of manufactures in different countries are broadly similar, but they are not identical. Gross value of output by manufacturing establishments is usually measured at factor cost, but sometimes, as in the West German census of 1958, is at market prices (including in the latter event excise and other indirect taxes and excluding subsidies). Items deducted from gross value to arrive at value added by manufacture generally include materials, supplies, fuel, and energy, but may differ in other respects. Depreciation is not usually subtracted out, but India does so (though reporting it separately and thus permitting adjustment). As may be seen in Table 3, above, the United States does not deduct purchased services, but recommendations adopted by the United Nations indicate that those of an "industrial nature," including maintenance and repairs performed by outside firms, should be deducted.[17]

Differences may also arise in what is included in wages and salaries and, therewith, in the separation made here between wage and nonwage value added. At least in principle, wages and salaries cover all payments made to employees whether in cash or in kind. It is not certain, however, that practice is uniform in this respect, and there seems to be still greater room for divergence in the treatment of various supplementary benefits, such as bonuses and contributions to social insurance. The earlier discussion of Table 3 makes it clear also that reported totals of wages and salaries may vary among industries and countries with differences in the prevalence of unincorporated enterprises and of multiestablishment firms. Moreover, the employment figures may inject some erratic elements into the derived averages of wage and nonwage value added per employee. This would be so if, for instance, seasonal or other part-time work is more common in certain industries in one country than in the same industries in another country.

Strict international comparability cannot therefore be expected in the available data on value added per employee in manufacturing. Were it not for these difficulties, the similarities found in the interindustry structure of value added might well be even closer than those reported below.

[17] *International Recommendations in Basic Industrial Statistics,* Series M, No. 17, Rev. 1, New York, United Nations, 1960, pp. 45–57. There is, however, room for serious doubt as to the feasibility of reporting and deducting such services unless the statistics are placed on a company (rather than establishment) basis, in which case they may lose greatly in precision by type of product covered.

Differences in Industries or Products Compared

Other and perhaps more serious problems arise with respect to the comparability of the industries or products specified in the various national censuses of manufacture. In principle, one would like to be able to make intercountry comparisons over a wide range of identical products. In practice, the smallest reporting unit is the manufacturing establishment, which can be classified according to its major product, but may make other products as well. The degree of product specialization is very high in the United States,[18] but may be less so in other countries, for which little information on this point is available. In any event, returns from individual establishments have to be combined into totals for industries and industry groups. What are ostensibly the same industries or groups in two countries—say, fertilizers or, at a higher level of aggregation, agricultural chemicals or, still higher, chemicals and allied products—may in fact differ significantly in composition of output. Even superficially, however, national classifications differ markedly in the kind and amount of industrial detail listed. International comparisons therefore necessarily entail further aggregation of items on one side or the other, or both, in the effort to achieve at least a nominal similarity of industries and groups, and therewith entail also a further loss of specificity.

The best chance of matching like with like no doubt lies in working at the lowest level of aggregation permitted by the data. This, however, may mean some sacrifice of reliability of the statistics reported, particularly those covering small industry groups in less developed countries (for which the reporting firms are likely to be either fewer in number or less able to comply closely with reporting requirements than firms in more fully developed branches of industry). Thus, the accuracy of the statistics is likely to be greater at higher levels of aggregation but, as noted, with greater uncertainty as to the comparability of the outputs covered. Given this dilemma, the course followed here is to give, first, some extremely broad comparisons for a large number of countries; then to provide a further industrial breakdown, though still at a high level of aggregation, for a more limited group of countries; and, finally, to give the most detailed breakdown possible in bilateral comparisons between the United States, on the one hand, and the United Kingdom, Japan, and India, on the other.

[18] John W. Kendrick, *Productivity Trends in the United States,* Princeton for NBER, 1961, pp. 406–407.

Analysis of Three Summary Groups

Chart 7 presents data for twenty countries on value added in three very broad groups of industry, exclusive of food, beverages, and tobacco.[19] The composition of the three groups has been determined by reference to the data for the United States presented in Chart 1. Thus, Group I consists of those industries which, in the United States, appear to be most labor-intensive by the criterion of value added—i.e., clothing, textiles, leather goods, furniture, other wood products, and miscellaneous manufactures. Group III includes just two major industry groups, chemicals and petroleum refining, which in the United States are the most capital-intensive of all. And Group II comprises machinery, electrical goods, basic metals, and various other major industry groups which are, on the average, relatively capital-intensive, though much less so than those in Group III, and (as noted for the United States in Chapter 2) some of their component industries fall within the labor-intensive sector.

At least as far as these three broad groups of industry are concerned, the pattern found for the United States with respect to value added per employee and its wage and nonwage components is fairly well confirmed by most other countries. The averages rise appreciably in almost all cases from Group I to Group II, and in all cases from Group II to Group III. In the first comparison Argentina and Colombia are the only exceptions. The distortion of the relative position of the industry groups in Argentina, compared with other countries, probably reflects the high degree of state intervention under Perón, notably in wage policies that favored the *descamisados* irrespective of skills. It is also interesting to observe, however, that the spread of average wages from Group I to Groups II and III is wider in the United States and Canada, and wider still in Japan, than it is in a number of other countries, including some of the less developed countries in addition to Argentina. As noted in Chapter 4, this subdued variability in wages may bear unfavorably on the ability of such less developed countries to compete in labor-intensive manufactures.

The percentage distributions of value added given on the left side of Chart 7 show a remarkably stable pattern for the developed countries. Among these countries, with one or two slight exceptions in each case, the industries in Group I account for some 20 to 25 per cent of

[19] The industries included in each group are identified at the top of the chart by their numbers in the International Standard Industrial Classification, the names of which are given in the note to the chart.

total value added in manufacturing, exclusive of food, beverages, and tobacco, those in Group II for 65 to 70 per cent, and those in Group III for 10 to 15 per cent. Not surprisingly, the share contributed by Group I, the labor-intensive industries, is much higher and exhibits more variability in the less developed countries depicted in the chart, usually falling in the range of 30 to 50 per cent and rising even higher in Egypt and Pakistan. The share of Group III is also generally higher in these countries, while that of Group II is usually not more than 50 per cent.[20]

If food, beverages and tobacco are also included in Group II,[21] the effect is rather uneven among the less developed countries. So far as can be judged by the reported data for these countries, the share of the food, beverage, and tobacco segment in total value added varies widely, and value added per employee in this segment is sometimes appreciably higher and sometimes appreciably lower than the corresponding over-all average. The coverage of these industries is, however, likely to be particularly uneven in less developed countries, depending, for instance, on the minimum size of reporting establishments and on how strictly small firms are made to report. For this reason, it has seemed preferable in the summary comparisons offered in Chart 7 to analyze the rest of manufacturing undisturbed by differences from country to country in the reported position of food, beverages, and tobacco. In any event, this omission chiefly affects the distribution of value added among the three main groups of industry presented and does not materially influence the comparisons made of interindustry differences in value added per employee.

Analysis of Thirteen Main Groups

Comparisons extending over all thirteen industry groups distinguished in *The Growth of World Industry* are given for nine countries in Charts 8–10. The countries selected include all of those, save Argentina,[22] with

[20] For a review of the literature on product-mix variations among countries at varying levels of development, see Yahr, "Estimating the Elasticity of Substitution," Chapter 6. Yahr also demonstrates that product-mix variations among countries are related to the skill levels of their labor forces; i.e., the underdeveloped countries specialize in industries requiring relatively more unskilled labor, and the developed countries specialize in industries requiring relatively more skilled labor.

[21] These industries (numbers 20, 21, and 22 of the ISIC) are treated as a single group in *The Growth of World Industry, 1938–1961: National Tables* (United Nations, 1963) and are therefore treated in the same way here.

[22] Argentina is less relevant as a test of the value-added criterion if, as suggested above with reference to Chart 7, the relative positions of different industries and labor groups were strongly influenced by policies under Perón.

CHART 7

Summary Analysis of Value Added by Manufacture in Twenty Countries: Three Groups of Manufacturing Industry Excluding Food, Beverages, and Tobacco

(Composition by ISIC code: I = 23–26, 29, 39; II = 27, 28, 30, 33–38; III = 31–32)

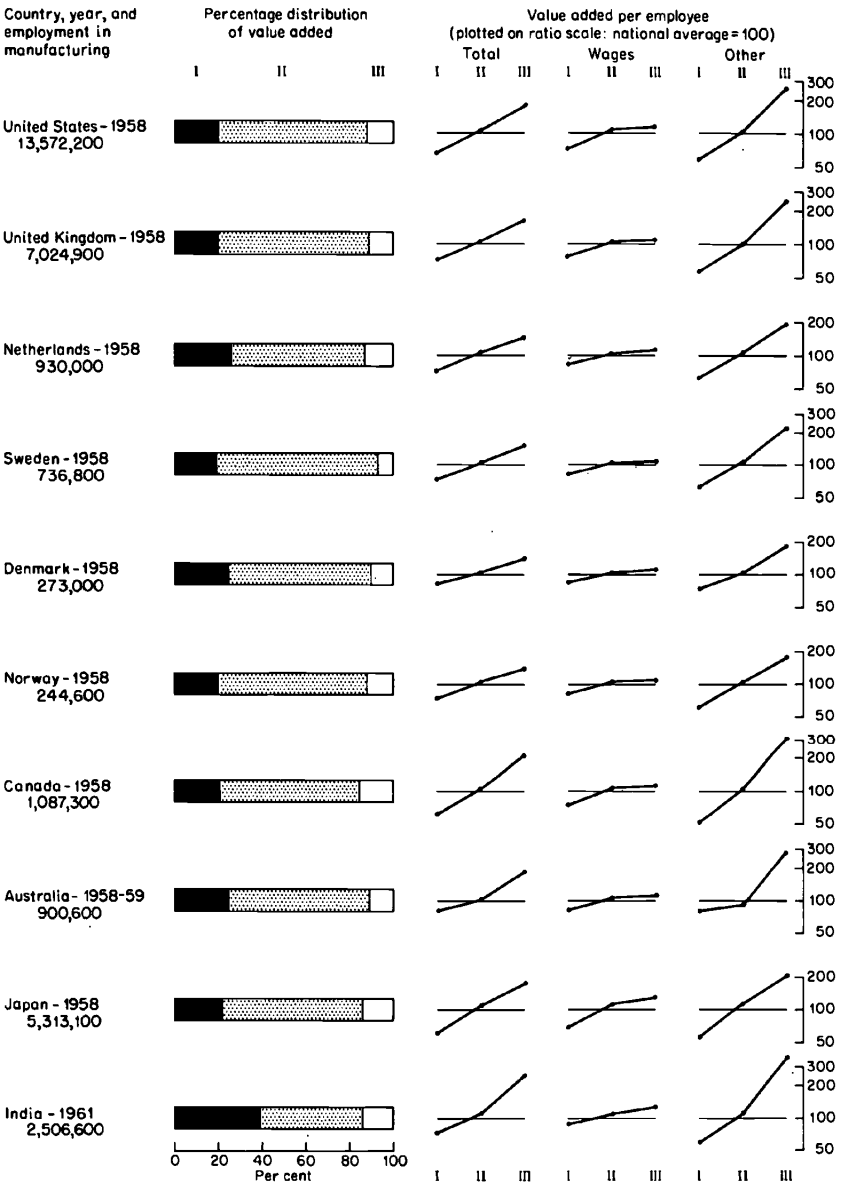
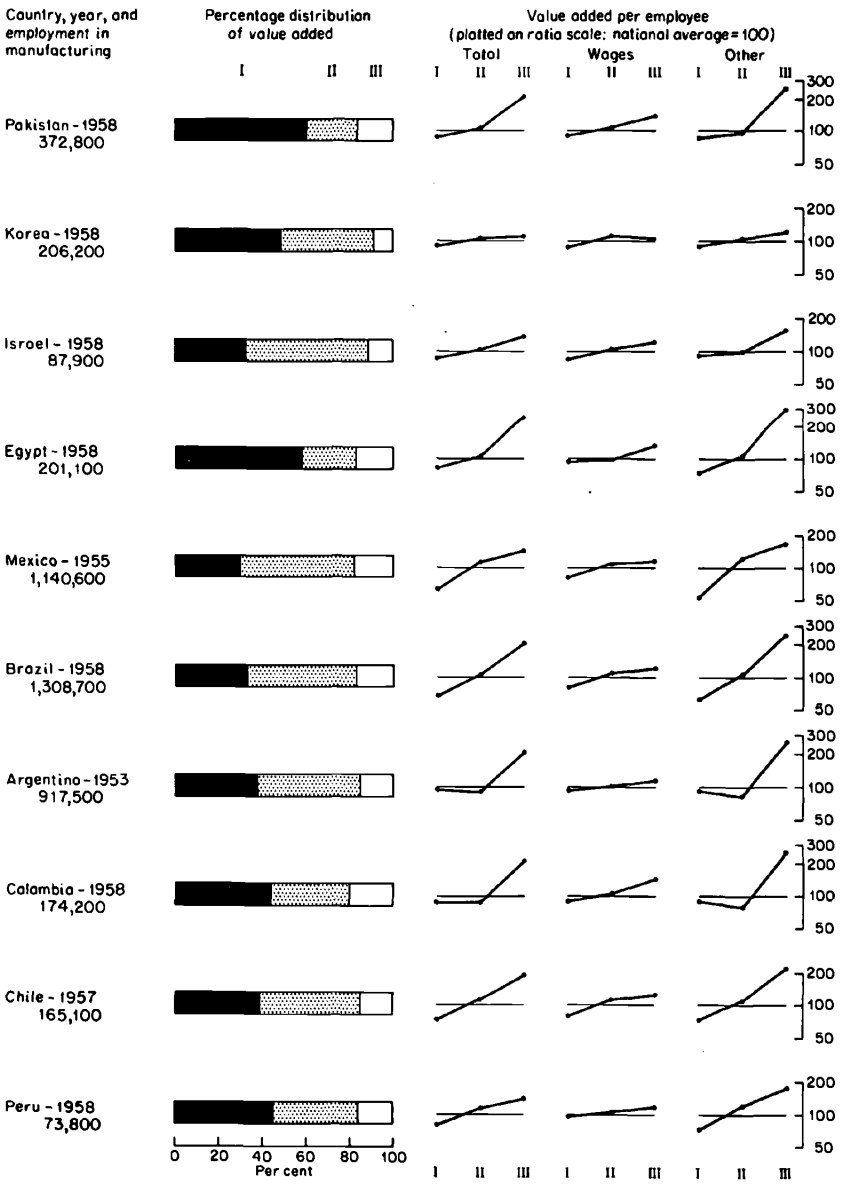


CHART 7 (continued)



Note on Sources of Data and Composition of Industry Groups in Charts 7–10

All data are from *The Growth of World Industry, 1938–1961: National Tables*, United Nations, 1963, and, for India, from the *Annual Survey of Industries, 1961*, Calcutta, 1964, Vol. I. Employment figures are as given in the national censuses of manufactures and in some cases exclude enterprises below a specified size. The composition of the industry groups is as follows:

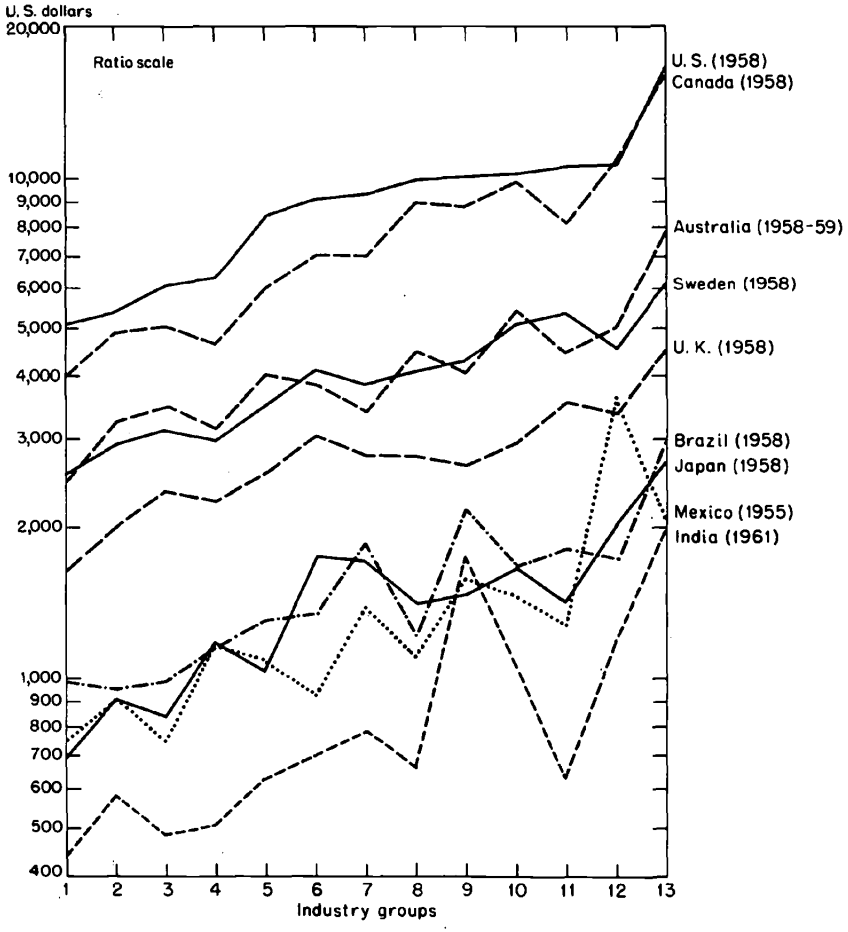
Major (Two-Digit) Industry Groups in the International Standard Industrial Classification	*Group to Which Assigned in Chart 7*	*Number Given in Charts 8–10*
20 Food	Omitted	11
21 Beverages		
22 Tobacco		
23 Textiles	I	2
24 Clothing, footwear, and made-up textiles	I	1
25 Wood and cork products	I	3
26 Furniture and fixtures		
27 Paper and paper products	II	10
28 Printing and publishing	II	6
29 Leather and leather and fur products	I	4
30 Rubber products	II	9
31 Chemicals and chemical products	III	13
32 Petroleum and coal products		
33 Nometallic mineral products	II	8
34 Basic metals	II	12
35 Metal products, except machinery and transport equipment	II	7
36 Machinery, except electrical		
37 Electrical machinery, apparatus, appliances and supplies		
38 Transport equipment		
39 Other manufacturing	I	5

Bracketed groups are combined in the United Nations source specified above, and each such combination is therefore treated as a single group in the present analysis.

Two deviations from the general pattern followed in the United Nations source may be noted: (1) In the data for Brazil, group 35 is combined with group 34, affecting Charts 8–10. (2) In the wage and salary data for Sweden, group 34 is combined with groups 35–38, affecting Charts 9 and 10 (but not Chart 8).

CHART 8

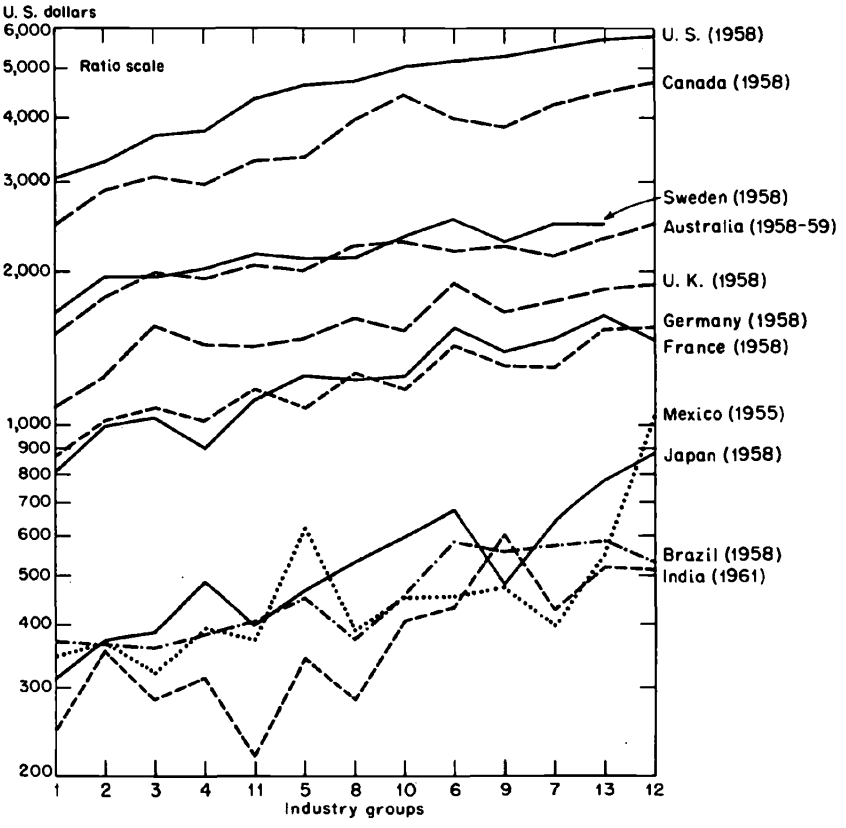
Value Added per Employee in Thirteen Industry Groups, Nine Countries



Note: See explanatory note following Chart 7.

CHART 9

Average Annual Wage in Thirteen Industry Groups, Eleven Countries



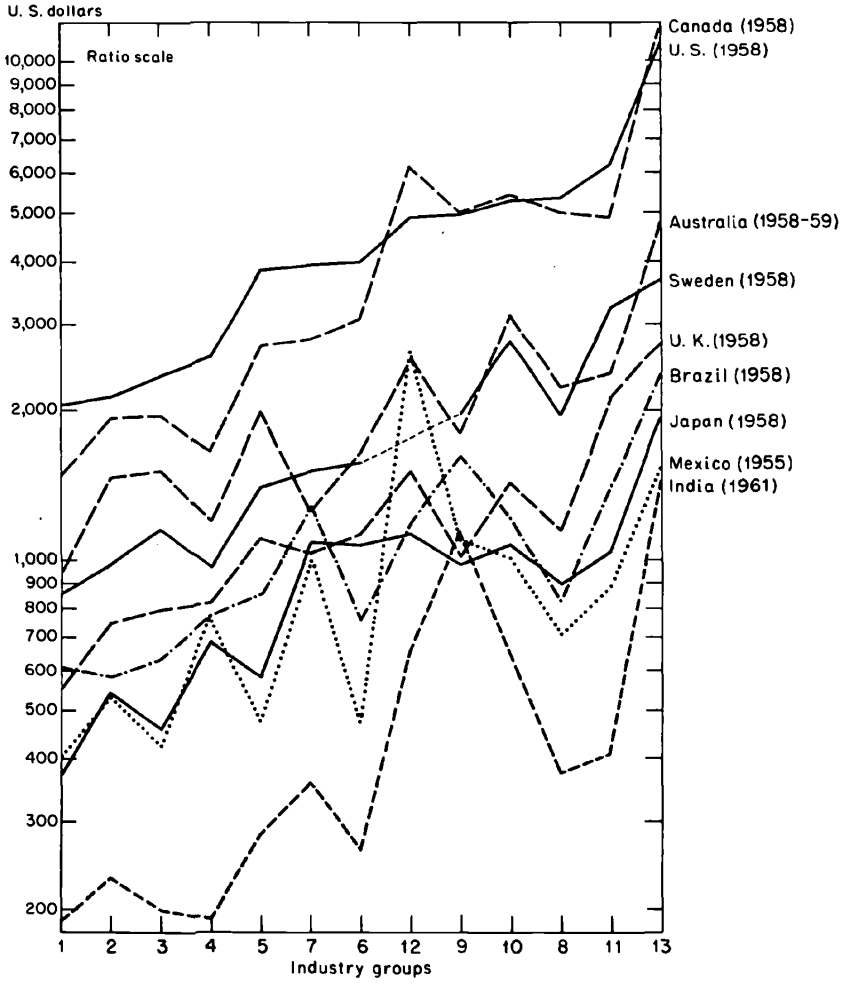
Note: See explanatory note following Chart 7.

employment in manufacturing close to or over one million and for which reasonably comparable data are given in the source on the thirteen industry groups. Unfortunately, none of the larger Continental European countries could be included,[23] but otherwise the nine constitute

[23] Value-added data are totally lacking for France and Italy in *The Growth of World Industry* and are given for West Germany on a market-price rather than factor-cost basis. Wage data for France and West Germany are, however, included in Chart 9. As previously noted, all three countries conducted censuses of manufacture in 1963, but the results became available only with great delay and too late for inclusion in this analysis.

CHART 10

Nonwage Value Added per Employee in Thirteen Industry Groups, Nine Countries



Note: See explanatory note following Chart 7.

an interesting selection. The United States, the United Kingdom, and Sweden are highly developed economies of long standing and important exporters of manufactures. Canada and Australia are also highly developed countries, as measured by real incomes or by the share of the

labor force outside primary production, but depend heavily on primary products for their exports. Japan, after the swift postwar growth of its production and exports of manufactures, can be regarded as a more recent addition to the group of developed countries and still shows similarities with the less developed countries in the composition of its exports and in the level and structure of its wages. Mexico, Brazil, and India are less developed countries, but differ from each other in the level of development so far attained, and none of them has yet become a major exporter of manufactured products.

Chief interest attaches to the shapes and slopes of the curves presented in the charts, and less importance should be attributed to their levels relative to each other, given the problem of converting data for other countries into dollars on a meaningful basis.[24] There can be no doubt, however, that the value-added data for the nine countries extend over a very wide range. Taken more literally than they should be, the average value added per employee in all manufacturing is some $9,000 for the United States as of 1958, $1,500 for Japan in the same year, and $800 for India in 1961. Similarly, wages and salaries per employee average approximately $5,000 for the United States, $500 for Japan, and less than $400 for India in the years indicated.

The differences just noted in average wages do not, of course, imply equal differences in labor costs per unit of output, given the wide differences among countries in the efficiency of labor. Nevertheless, these differences in average wages, along with manifest disparities in the relative supplies of skilled and unskilled labor, would seem to provide strong inducements in low-wage countries to substitute unskilled labor for skilled labor or physical capital to the extent permitted by the technological conditions of production. And if these technological possibilities are significantly greater in some industries than in others, one would expect to find the effect registered in differences in the shapes and slopes of the curves in the charts.

To facilitate comparison, all three charts are arranged in ascending order of the variables plotted for the thirteen industries in the United States. The sequence of industries varies somewhat from one chart to another, but the numerical identifications given in Chart 8 are retained in the other two. Visual inspection shows some sharp deviations,

[24] Conversions have been made at official exchange rates or, in the case of Brazil, at the "official" free rate in 1958 (138.5 cruzerios to the dollar). Note in particular that the position of Brazil relative to that of the United Kingdom and Japan seems highly suspect, especially in Chart 10, above, on nonwage value added per employee.

but nevertheless suggests in all three cases a fairly strong conformity to a common pattern. A measure of the degree of conformity is provided by Kendall's coefficient of concordance,[25] the coefficients obtained being given below together with the computed chi-squares test, indicating that all of the coefficients are significantly different from zero at the 1 per cent level of confidence:

	Coefficient of Concordance	*Chi Square*
Total value added per employee, nine countries	0.853	92.12
Wage value added per employee, nine countries	0.828	89.42
Ditto, including France and West Germany	0.843	91.04
Nonwage value added per employee, nine countries	0.829	89.53

The deviations observable in comparisons among the developed countries are all relatively minor, particularly in total value added per employee. And even here one would want to allow something for less than perfect comparability of outputs in the different industries as well as for the kinds of statistical aberration previously warned against.

Some of the deviations which can be observed in comparing the less developed countries with the United States and other developed countries are more disturbing. Value added per employee (along with nonwage value added per employee) seems very high in rubber products (No. 9 in the chart), compared with the rest of manufacturing, in India and, to a lesser extent, also in Brazil—a result suggesting that the production of tires and tubes, which figure prominently among rubber products in these countries, is less amenable than other industries to the substitution of unskilled labor for capital.[26] Value added per employee is also exceptionally high in basic metals (No. 12) in Mexico (and this observation extends to both the wage and the nonwage components) and in the chemicals and petroleum refining group (No. 13) in India.

Deviations in the other direction may be observed in the food, beverages, and tobacco group (No. 11) in India and, much less markedly, in Mexico, but not in Brazil, though the significance of intercountry differences in this group has already been questioned above. Perhaps a slight tendency for nonmetallic mineral products (No. 8) and some other items to fall out of line may also be detected.

[25] See Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences,* New York, 1956, pp. 229–239.

[26] The extraordinarily high figures for the rubber industry in India and some other less developed countries may reflect the success which they have had in inducing the large American and European tire manufacturers to establish plants in their area.

One can therefore find a few wide deviations and a number of minor ones in comparing the ordering of industry according to the value-added criterion in developed and less developed countries. But there is really nothing that could be regarded as a clear-cut swapping of places between industries on the left side and those on the right side of Chart 8 —that is, between those which, in the United States, rank as labor-intensive and those which rank as capital-intensive. On the contrary, the major deviations noted—rubber products in India and Brazil, basic metals in Mexico, and chemical and petroleum products in India—are in the direction of accentuating the difference. This evidence is thus consistent with the observations based on the more summary data given in Chart 7.

Detailed Bilateral Comparisons

Finally, three bilateral comparisons are undertaken in much finer detail by industries, entailing the establishment of at least a rough concordance between the U.S. classification and that employed by each of the other countries considered. This approach is taken with a view to providing closer comparability of the industries examined than can be assumed with respect to the very broad groups hitherto studied. At best, however, the data compared still relate to the output of apparently similar industries rather than to identical products.

The United Kingdom, Japan, and India have been selected for these comparisons because of the availability of the statistics needed and because of the interest offered by their contrasting economic situations in relation to each other and to the United States. India is of special importance in this analysis since it is still very low in the scale of economic development and in wage levels, and yet, with its great size, has a larger manufacturing sector and probably a better census of manufactures than any other less developed country.

The number of industries entering into these bilateral comparisons varies, depending on the amount of industrial detail originally reported by the partner country, on the extent to which two or more of its items have had to be combined in the effort to establish comparability with the United States, or vice versa, and on the number of items which, in some cases, have been deleted for lack of a clear counterpart in the U.S. statistics. It should be noted that the amount of industrial detail reported in the U.S. *Census of Manufactures* is very great, comprising 417 four-digit items in the 1963 census. The Japanese census of 1962 is even more detailed, providing 501 items, and has the further ad-

vantage for present purposes of being laid out on lines similar to the U.S. Standard Industrial Classification. After the combinations and deletions made for the reasons indicated, 178 items have been used in comparison with the United States.[27] The British census of 1958 contains fewer items, 109 in all, of which 103 have been retained for comparison.[28]

The Indian census is based on the International Standard Industrial Classification but in more detailed form, giving altogether 194 items. In addition, however, to those industries which have had to be left out because of no clear U.S. equivalent, others have been deleted because of a preponderance of repair work as distinguished from manufacturing proper. After combination of some other items in the interest of comparability, 117 Indian industries remain for present purposes.

United States and United Kingdom

The United States and the United Kingdom show a strong similarity in the pattern of value added per employee in different industries, plotted in Chart 11 in logarithmic form.[29] The correlation coefficients given in Table 6 (all of which are significant at the 1 per cent level of confidence) indicate further that this close relation is found also in both wage and nonwage value added in the two countries. Roughly three-quarters of the interindustry differences in these variables in the United Kingdom [30] may be held to be "explained" by the United States pattern. To the extent that, on evidence such as that examined in Chapter 2, the United States pattern reflects variance in the intensity of human and physical capital inputs in different industries, these influences would also go far toward explaining the English pattern. Other forces, such as the rate of unionization and of advertising, may, however, also show a similar industrial pattern in the two countries and to this extent would help to explain the relations observed.

[27] Appendix B provides more specific information on these points, and Tables B-1, B-2, and B-3 give the names of industries and the variables used in all three bilateral comparisons.

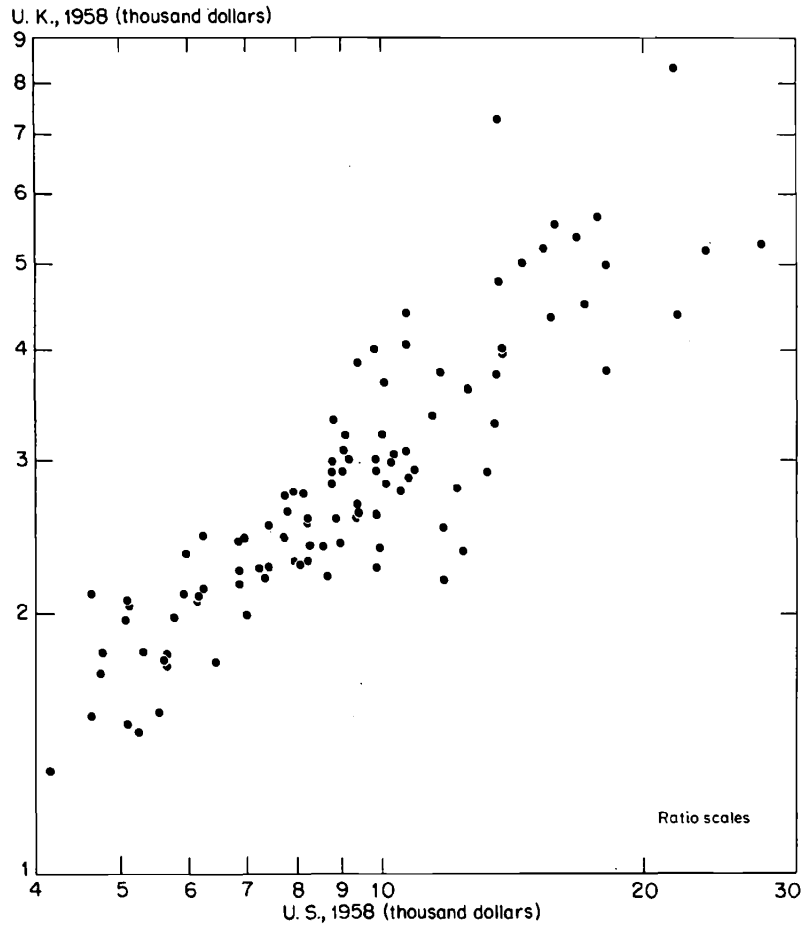
[28] Unfortunately, the results of the 1963 census of manufacture in the United Kingdom were not available in time for use in this study.

[29] It will be noted that all three of the bilateral correlations given here are in logarithmic form. As stated in Chapter 2, footnote 30, there is no basis in economic theory for determining in advance whether this form or the arithmetic form is appropriate. To assist in this determination, tests for linearity and for homoscedasticity have been made; the results of these tests are given in Appendix B.

[30] $\bar{R}^2$, adjusted for the number of observations, is 0.775 for value added per employee, 0.719 for wage value added per employee, and 0.728 for nonwage value added per employee.

CHART 11

Value Added per Employee in 103 Manufacturing Industries, the United Kingdom and the United States



Source: See Appendix B.

United States and Japan

The comparison with Japan gives appreciably lower coefficients of correlation (though still significant at the 1 per cent level of confidence) than that with the United Kingdom for each of the three variables, but the United States pattern may nevertheless be said to "explain" over half of the interindustry variance in value added per employee in

TABLE 6

Coefficients of Correlation Obtained in Detailed Log Correlation Analysis of Value Added, Wage Value Added, and Nonwage Value Added per Employee, in the United States and the United Kingdom, Japan, and India

Countries Compared and Year of Census	Number of Industries in Correlation	Value Added per Employee		
		Total	Wage	Other
U.S. (1958) and U.K. (1958)	103	0.882	0.849	0.855
U.S. (1962) and Japan (1962):				
Maximum list of industries	178	0.753	0.778	0.690
Excluding nine extreme derivations	169	0.806	0.782	0.743
U.S. (1963) and India (1961):				
Maximum list of industries	117	0.600	0.494	0.599
Less industries with employment under 1,000	100	0.622	0.520	0.635
Less industries with employment under 2,000	83	0.634	0.553	0.658
Excluding also seven extreme deviations	76	0.786	0.518	0.785

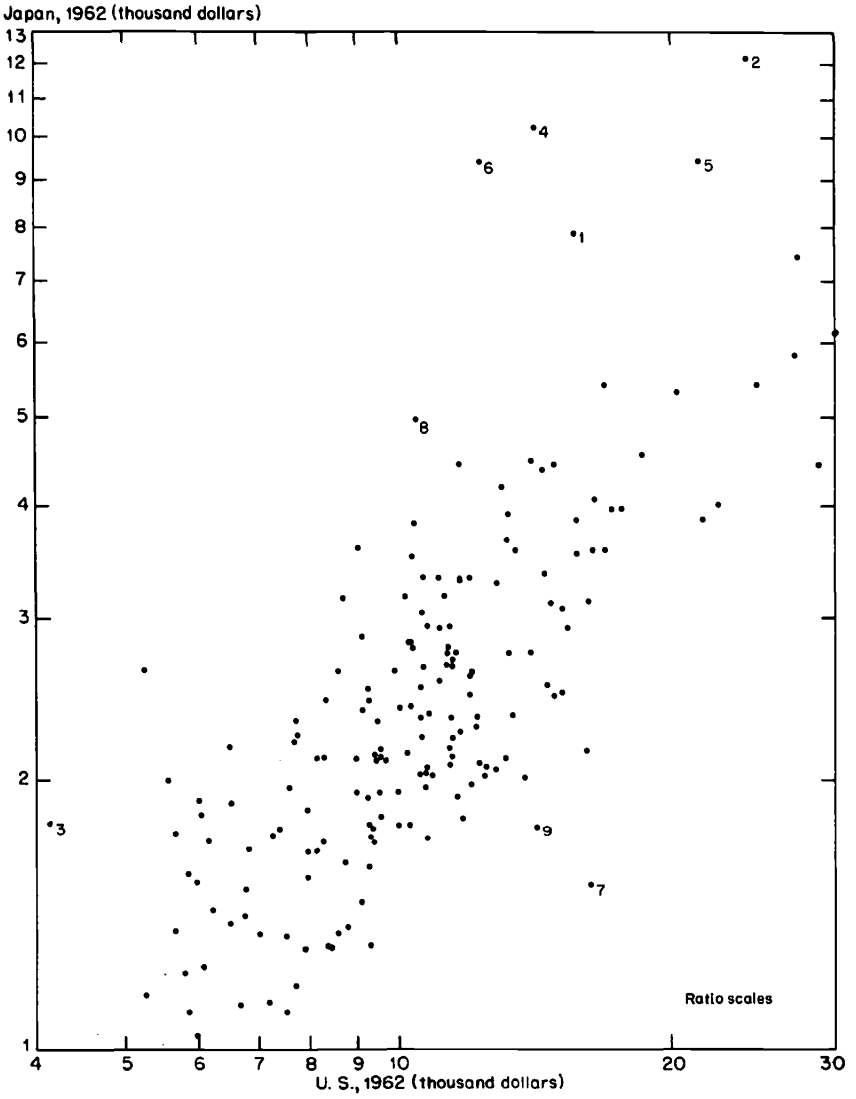
Source: See Appendix B.

Japan.[31] Much of the remaining variance is attributable to nine industries in which, as indicated by Chart 12, value added per employee in Japan deviates exceptionally widely from the United States pattern. In seven of these industries the deviation is on the high side, and it may be significant that total value added in the seven industries in Japan is also extraordinarily high in relation to reported payrolls, at least as judged once more by corresponding data for the United States. Expressed the other way round, the percentage share of payroll in total value added in these industries in the two countries is as follows:

[31] The adjusted $\bar{R}^2$ is 0.57 for value added per employee, 0.60 for wage value added, and 0.47 for nonwage value added.

CHART 12

Value Added per Employee in 178 Manufacturing Industries, Japan and the United States



Source: See Appendix B.

Note: Numbered points identify industries in which value added per employee in Japan deviates by two standard errors of estimate or more from the value indicated by the regression equation. The industries and their percentage deviations are as follows: (1) sugar, +124; (2) petroleum refining, +128; (3) leather gloves, +84; (4) flat glass, +222; (5) hydraulic cement, +98; (6) steam engines and turbines, +236; (7) electric lamps, −58; (8) radio and television sets, +107; (9) photographic equipment, excluding film, −45.

	Japan	*U.S.*
Petroleum refining	12.8	30.6
Hydraulic cement	16.5	29.1
Sugar	17.0	36.7
Flat glass	17.4	51.6
Steam engines and turbines	13.1	60.0
Radio and television sets	14.8	47.0
Leather gloves	28.6	72.7

In several of these industries the share of payroll is so low as to leave the accuracy of the Japanese figures open to question,[32] though in some cases the return on capital may be exceptionally high in Japan.[33]

Of the two instances of very wide negative deviation in Japan marked in Chart 12, one concerns an industry, electric lamps, for which non-wage value added per employee in the United States has been found to be high in relation to physical assets (Table 4). It may be, therefore, that the factor intensity of the industry is better indicated by its ranking in Japan, which would place it in the labor-intensive category. The other industry, photographic equipment, would also be in this category by its relative position in Japan, and may provide an example of significant factor-intensity reversal between the two countries. Even here, however, it may be the product itself which is adapted, rather than the technology of producing the same product, to differing conditions of factor supply and factor costs, since American and Japanese cameras can probably be regarded as rather different instruments catering to different buyers.[34]

[32] The share of payroll in value added by manufacture is, however, generally much lower in Japan than in the United States (32 per cent against 50 per cent in manufacturing as a whole in 1962), partly because a greater part of labor compensation is in noncash forms.

[33] In response to an inquiry from the author as to possible reasons for the large deviations in question, Hirotaka Kato (Kanagawa University) suggests that some of those on the high side, notably in petroleum refining and hydraulic cement, may reflect a markedly higher degree of industrial concentration in Japan than in the United States, and he further notes, with respect to deviations in the opposite direction, a much higher concentration in electric lamps in the United States than in Japan.

[34] There are, of course, numerous lesser shifts of position. Among the industries which, by the value-added criterion, would rank as more labor-intensive in Japan, relative to the rest of Japanese industry, than in the United States are cotton cloth and other woven goods, carpets, canned fruits and vegetables, rubber footwear, ceramic wall and floor tile, primary batteries, medical instruments, and toys and sporting goods. Shifts in the opposite direction include yarn, lace goods, certain agricultural chemicals, leather handbags and purses, some types of office machines, industrial trucks and tractors, and storage batteries.

United States and India

The analysis for the United States and India, taking the full list of industries selected for comparison, produces lower correlation coefficients than those found for the United States and Japan. A number of the industries compared are still in an embryonic state in India, however, and may constitute a less representative sample, or provide less accurate statistical reports, or use different production processes, than would more fully developed industries. Progressively higher coefficients of correlation are found by eliminating, first, industries employing fewer than 1,000 and, next, those employing fewer than 2,000.

Inspection of the data plotted in Chart 13 shows that seven industries account for very wide deviations from the pattern indicated by value added per employee in the United States. Given the exceptionally wide gaps separating these industries from the other observations, it is pertinent to note that their exclusion from the regression analysis results in a marked increase in the correlation of value added per employee in the two countries (Table 6). This is also true of nonwage value added, but not of wage value added.

As indicated by the chart,[35] all seven of the industries singled out are relatively capital-intensive in the United States, according to the value-added criterion. Three of them—petroleum refining, tires and tubes, and dyestuffs—are even more so in India in relation to the general run of its industry. As suggested earlier in the analysis of Charts 8–10, these industries seem to exhibit a very low elasticity of substitution of unskilled labor for capital, though it is also likely that the relatively high value added in India includes a large element of monopoly-rent attributable to restrictions on imports and on new entries into production in these fields. The remaining four industries are much more labor-intensive in India than in the United States, relative in each case to the rest of manufacturing industry. There is room for doubt, however, as to the comparability of wines and spirits and perhaps also perfumery products [36] between the two countries, though this may be less true of such items as milled rice and salt.

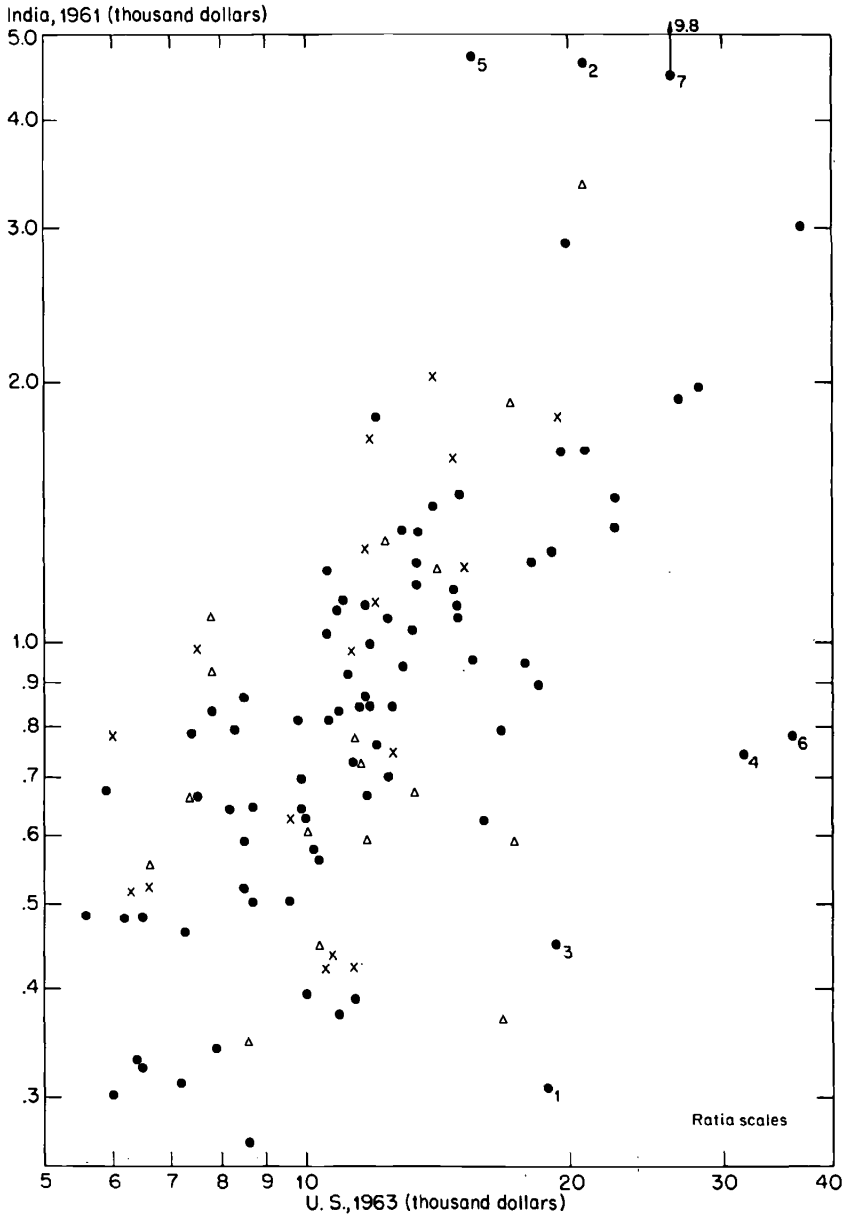
These last two products would therefore seem to furnish the principal instances of possible reversals of factor intensity emerging from this comparison of manufacturing in the United States and India. Another,

[35] See also Table 2.

[36] The perfumery industry in India includes a relatively large amount of processing of essential oils for export. Even rice and salt would differ between the two countries in packaging for the consumer and perhaps also in sanitary controls.

CHART 13

Value Added per Employee in 117 Manufacturing Industries, India and the United States



Source: See Appendix B.

Note: Industries with employment under 1,000 in India are marked Δ, and those with employment from 1,000 to 2,000 are marked ×. Numbered points identify industries in which value added per employee in India deviates by two standard errors of estimate or more from the value indicated by the regression equation. The industries and their percentage deviations are as follows: (1) rice mills, −77; (2) dyestuffs, +225; (3) salt, −66; (4) spirits and wine, −66; (5) tires and tubes, +331; (6) perfumes, cosmetics, and other toilet preparations, −67; (7) petroleum refining, +455.

less sharp but perhaps of greater potential commercial significance, is flat glass, whose position in the Indian scale contrasts remarkably with that which the Japanese statistics would indicate. There are, of course, numerous other more moderate shifts of position, as is evident from the dispersion of observations in Chart 13. The ones clustered in the lower left area of the chart are of particular interest, including as they do apparel, woven carpets, chinaware, glass products, and castings and forgings. These are all products which are labor-intensive in the United States and still more so, relative to the rest of industry, in India. But this kind of moderate shift in comparison with United States factor intensities gives little support to the idea that factor-intensity reversals are a common and significant feature of the international economy.

To sum up, the international comparisons made in this chapter tend to support the general validity of the strong-factor-intensity hypothesis and, more particularly, the relevance of the United States pattern of factor intensities to other countries at very different levels of development and with very different factor-price ratios. By the criterion of value added per employee, some industries appear to be more labor-intensive in one or more foreign countries, and others less so, than in the United States. But few of these shifts could be regarded as clear and significant reversals of factor intensity. They are consistent with Samuelson's impressionistic judgment some years ago that "the phenomenon of goods that interchange their roles of being more labor intensive is much less important empirically than it is interesting theoretically." [37]

Technological Advance and Factor Intensities: The Case of Cotton Textiles

Apart from any influence which may be exerted by differences in factor-price ratios, the interindustry pattern of factor intensities may change because the rate of technological advance is faster in some industries than in others, leading to new combinations of the factors of production. And these changes may be registered sooner in some countries than in others, depending on technological leadership, entrepreneurial initiative, and the conditions of competition.

In recent years a good deal of attention has been given to the rate of technological progress and changing factor proportions in textiles, especially cotton textiles. Thus, *A Study on Cotton Textiles,* prepared

[37] Paul A. Samuelson, "A Comment on Factor Price Equalisation," *Review of Economic Studies,* Vol. XIX (2), No. 49, 1951–52, pp. 121–122.

by the GATT Secretariat,[38] states that "the industry is continually improving its performance through a shift to new types of equipment embodying technical advances and innovations at every stage of production," and that "the cotton industry in the industrialized countries and some of the less-developed exporting countries is undergoing fundamental changes. Use is being made of huge investments for this new equipment," the GATT study reports, and it adds: "A modern cotton industry is regarded as being among the most highly capital-intensive of the manufacturing industries."

How far this and other similar assessments are correct is important for reasons that transcend the identification of labor-intensive manufactures for analytical purposes. For one thing, technological advance in textiles is thought to have been stimulated by the rapid growth of exports by some of the less developed and other low-wage countries. Developments in the industry could therefore be regarded as illustrative of the kind of competitive response which, in still other products, could slow down or even thwart the growth of exports by less developed countries. Second, the prospect of a highly capital-intensive cotton textile industry is sometimes invoked as a reason why, in the meantime, imports from less developed countries should be curbed. Commercial policy is thus summoned to the support of economic projections.

This last view, with its reborn-infant-industry implications, is most strongly expressed in a report prepared by the Special Committee on Textiles of the OECD and published under the title *Modern Cotton Industry—A Capital-Intensive Industry*.[39] "Only a few years ago," the Special Committee states, "it was usual for the textile industry to be cited by economists as one of the so-called 'labour-intensive' industries, i.e. those whose production depends primarily on manpower. Although this may still be true for certain branches of the textile industry, it is no longer so for cotton which is increasingly becoming a capital intensive industry with investments easily amounting to $20,000 per workplace." This transformation, the report goes on to say, is "practically complete in the United States and Japan, but still slowly proceeding in Europe."

Tariff barriers, the OECD Special Committee states, are not high

[38] General Agreement on Tariffs and Trade, Geneva, July 1966. The passages cited are from page 55.

[39] Published by the Organization for Economic Cooperation and Development, Paris, 1965. The quotations given here are from pages 95 and 131–133. Reasons for a modern and efficient cotton textile industry in the United States and Japan are given on page 17.

enough, with some exceptions, to provide effective protection to the cotton textile industry, "particularly against imports from low-cost countries," and "the impermanence of quotas, due to the rules at present governing international trade, offers the industry only temporary security." Turning to the restraints on imports applied under the Long-Term Cotton Textile Arrangement of 1962 (further discussed in Chapter 4), the Special Committee says that the Arrangement will be successful only if the imports affected by it "can be regulated in such a way as to encourage and speed up any structural adjustments required to enable the cotton industry in Member countries to flourish, i.e. eliminate any excess of capacity, continually modernize plant, introduce two- or three-shift working in Europe, and seek new outlets for industries confined to the domestic market." [40]

While the rate of technological innovation in cotton textiles is impressive,[41] it may be exaggerated to suppose that the process is significantly faster than in manufacturing as a whole and to conclude that the industry is becoming strongly capital-intensive. Certainly, the assertion of the OECD Special Committee that such a transformation is "practically complete" in the United States and Japan is not borne out by the data already presented for these two countries.[42] Further data are given in Table 7 on the evolution in recent years of cotton weaving, the most important branch of the cotton textile industry. New investment per employee increased rapidly during the first half of the 1960's both in absolute terms and in relation to the average for all manufacturing, but nevertheless remained below that average.[43] Value added per

[40] The argument was summed up as follows by *The Economist* (London) in its issue of February 19, 1966 (pp. 723–725): "How do European textile manufacturers survive? On the almost universal assumption that their governments have in effect an obligation to protect them; and currently by basing their case for protection on the grounds that their much battered industries are now becoming so capital intensive, through re-equipment, that underdeveloped competitors like Pakistan will soon lose the advantage of their lower wages."

[41] See the section on textile mill products (pp. 148–154) in *Technological Trends in Major American Industries*, U.S. Department of Labor, February 1966.

[42] See particularly Table 2 (U.S. SIC code No. 2211) and Table B-2 (Japanese code No. 2031). Value added per employee in cotton weaving mills, in relation to the average for all manufacturing, is even lower in Japan than in the United States, being in the order of 43 or 44 per cent in each of the years 1961 to 1964.

[43] Congressman Thomas B. Curtis, ranking Republican member of the Joint Economic Committee, questioned the desirability of investing so much in the industry in a report delivered to the House of Representatives on August 29, 1966, in which he expressed strong opposition to the restrictions on imports imposed under the international Long-Term Cotton Textile Arrangement. His comments on the risk of overinvestment were as follows:

"The great increase of productive capacity for the U.S. textile industry is one

TABLE 7

Capital Expenditures, Value Added, and Employment in Cotton Weaving Mills (SITC 2211), 1947, 1954, 1958, and 1961–65

Year	New Capital Expenditures ($ million)	Value Added ($ million)	Total Employment (thousands)	Averages per Employee[a]		Percentage of Average in All U.S. Manufacturing	
				New Capital Expenditures (dollars)	Value Added (dollars)	New Capital Expenditures	Value Added
1947	79	1,449	330	239	4,388	56.9	84.4
1954	55	1,135	296	186	3,833	35.5	51.2
1958	48	1,079	243	199	4,431	32.0	48.3
1961	81	1,282	228	355	5,619	57.1	53.8
1962	115	1,346	224	513	6,020	79.4	54.3
1963	113	1,257	209	542	6,013	76.8	50.8
1964	138	1,404	204	678	6,896	83.7	55.1
1965	169	1,624	205	821	7,910	84.4	60.1

Source: *1963 Census of Manufactures* and *1965 Annual Survey of Manufactures*.
[a]Averages computed from data before rounding.

employee has also risen, but in 1965 was still only 60 per cent of the average for all manufacturing. Moreover, much of this increase may be attributed to the rise in profits in cotton textiles resulting from the strengthening of demand, particularly military demand, and from the elimination in August 1964 of the two-price system for raw cotton, which had discriminated against domestic buyers in favor of exports.[44] It cannot be assumed, therefore, that the rise in value added per employee can be projected on into the future.

It might be expected that if there were a basic trend toward a capital-intensive industry, it would be reflected in appreciably higher averages for some parts of the industry, or for some parts of the country, than for others. Yet an examination of nine product classes in weaving at the five-digit level available in the *1963 Census of Manufactures* shows none in which value added per employee was above 63 per cent of the average for all manufacturing. Similarly, the data for individual states and regions in the 1963 census provide only one instance, and that a minor one,[45] where the value added per employee in weaving was as high as 73 per cent of the average for all manufacturing and no other higher than 54 per cent.

In brief, the evidence considered for the United States is consistent with the view that there has been heavy investment in modernization in

of the key elements of concern about the future of that industry. The wiser policy would seem to be to unshackle import competition now, through more liberal administration of the Long-Term Arrangement, especially in those categories where unmet demand is greatest, rather than to allow our economic resources to be diverted to expanding portions of an industry which may prove to be uneconomic. The real danger is that the capacity being created will only increase pressure to protect this new capacity later even though it be inefficient. It is no favor to the wage earner to entice him into a job which has an unstable economic base."

[44] The after-tax return on capital in the textile industry (as reported by the Federal Trade Commission and the Securities and Exchange Commission) had been as high as 19.5 per cent in 1947 (accounting for the exceptionally high value added per employee in that year shown in Table 7). The rate fell to 12.6 per cent in 1950, 5.7 per cent in 1955, and was as low as 5.0 per cent in 1961 and 6.0 per cent in 1963. It then strengthened to 8.4 per cent in 1964 and 10.8 per cent in 1965 (*Statistical Abstract of the United States, 1966*, p. 497).

The elimination of the two-price system for raw cotton cut the price to domestic mills from 35.50 cents per pound in July 1964 to 27.64 cents in August. At the same time, the so-called mill margin (that is, the difference between the price paid by textile mills for raw cotton and the price at which they sell gray cloth to finishing mills) rose from 25.09 cents to 33.19 cents and continued to rise to 38.72 cents in May 1966 (from speech by Representative Thomas B. Curtis in the House of Representatives, August 29, 1966).

[45] That is, the Middle Atlantic region, accounting for only 1.2 per cent of total value added in cotton weaving in the United States in 1963.

the last few years in cotton textiles, but it gives little reason to think that the industry is becoming capital-intensive compared with manufacturing in general and ceasing to be appropriate to the factor endowments of the less developed countries. According to the criteria applied in this study, cotton textiles and the textile industry in general still rank among the most labor-intensive of the manufacturing industries, and they will be so treated in the analysis of trade in the next chapter.

The contrary view that a fundamental change in textiles is under way may rely unduly on comparisons with the industry's own past characteristics and performance, and fail to allow for the progress made by manufacturing in general. The illustrations frequently given of developments in the industry also suggest a tendency to confuse the technological optimum with average practice at any one time.