STRUCTURE OF COMPARATIVE ADVANTAGE IN INDUSTRIAL COUNTRIES : A VERIFICATION OF THE FACTOR-PROPORTIONS THEOREM*

By KIYOSHI KOJIMA**

I. *Introduction*

The "factor-proportions" theorem identified with Heckscher and Ohlin[1] provided a simple and persuasive basis for determining the structure of comparative advantage between trading nations. The Leontief paradox[2] presented empirical evidence contradicting the theorem. The Heckscher-Ohlin approach has been severely criticised and various alternative approaches to the explanation of trade have been developed.[3] Recently, much attention has been devoted to the theory of the "technological gap," "the product cycle," and the "R & D factors."[4] This theory may be appropriate in explaining what country creates new products (usually research and high capital intensity) and exports until the temporal sequence of the technological gap is supplanted by low wage trade.[5] One suspects that the significance of trade in these new products may be small relative to total world trade. Recently, Hal B. Lary presented an excellent empirical study, using value added per employee as a guide to factor intensity "to support the strong-factor-intensity hypothesis underlying the factor-proportions theorem and, more specifically, the relevance of the U.S. pattern of factor intensities to other countries

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** Professor (*Kyōju*) of International Economics.

[1] Eli Heckscher, "The Effect of Foreign Trade on the Distribution of Income," Howard S. Ellis and Lloyd A. Metzler, ed., *Readings in the Theory of International Trade*, Blakiston, Philadelphia, 1949, pp. 272-300 (originally published in the Swedish journal, *Ekonomisk Tidskrift* in 1919). Bertil Ohlin, *Interregional and International Trade*, Cambridge, Mass., 1st ed., 1933, revised ed., 1967.

[2] W. Leontief, "Domestic Production and Foreign Trade: The American Capital Position Re-examined," *Proceedings of the American Philosophical Society*, September, 1953.

[3] The most excellent survey on the development of causes of comparative advantage is provided by J. Bhagwati, "The Pure Theory of International Trade," *Economic Journal*, March 1964, pp. 1-84, and Harry G. Johnson, *Comparative Cost and Commercial Policy Theory for a Developing World Economy*, The Wicksell Lecture for 1968, Stockholm, 1968.

[4] G. C. Hufbauer, for example, calssifies "nature-of-trade theories" into the factor proportions account, the scale economy account, and the technological gap account, in his book, *Synthetic Materials and the Theory of International Trade*, Duckworth, London, 1966, p. 14.

[5] G. C. Hufbauer, *ibid.*, pp. 30-31. By low wage trade, we mean exports from low wage countries to high-wage countries which are predicated on lower wage costs, or more generally, on the factor-proportions theorem.

at very different levels of economic development and with very different factor-price ratios."[6] The present paper too intends to verify the validity of the Heckscher-Ohlin theorem based upon multi-country and multi-commodity trade model.

Using 1960-62 averages we have derived indicators of relative export performance for the United States, Canada, the European Common Market, the United Kingdom, Sweden, and Japan in regard to seventy-four categories of manufactured products.[7] My presumption in this paper is that, although trade relationships between countries in manufactured goods would be affected by various factors such as the size of country, the level of *per capita* income, the closeness of geographical, cultural, and historical relations, trade policies, the comparative advantage structures and the pattern of exports of industrial countries would follow the difference of factor price ratios along the line of the Heckscher-Ohlin theorem. Our verification of this presumption will be developed via a treatment of relevant topics in the sections which follow.

In Section II we will comment briefly on the most recent data as it relates to the verification of the presumption being tested here. Section III will be devoted to the devolopment of a theoretical model and the modifications needed to apply it to empirical verification. In Section IV evidence will then be offered to illustrate the basic propositions of the factor-proportions theorem by choosing apparently labour-intensive versus capital-intensive commodity groups. Section V will examine more closely the other propositions through a rank-correlation analysis between the series of export-performance indices.

II. *Recent Date*

We might well begin our discussion with a brief analysis of the most recent data, summarized as follows, to supplement the indirect factor-proportions theorem verification of Sections III-V.

i) As shown in Table 1, in terms of population and gross domestic product (GDP) the U.S. and EEC are large, Sweden and Canada small, and the U.K. and Japan in between. A smaller country may have to specialize in a limited number of industrial products while a larger country may be more able to diversify its production and exports.[8] This is confirmed by the fact that the order in the coefficient of variation (v) of export performance indices corresponds fairly well to the size of countries since the smaller the coefficient, the more equally the export performance ranges over all (74) commodities, and *vice versa*.[9] Sweden and Canada show this specialization type pattern most clearly.

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[6] Hal B. Lary, *Imports of Manufactures from Less Developed Countries*, National Bureau of Economic Research, New York, 1968, p. 15.

[7] The present paper is a by-product of my work with Bela Balassa and associates on *Studies in Trade Liberalization, Problems and Prospects for the Industrial Countries*, Johns Hopkins, Baltimore, Maryland, 1967. I followed Balassa's method of calculating export performance indices, though recalculated by myself. See, Bela Balassa, *Trade Liberalization Among Industrial Countries, Objectives and Alternatives*, McGraw-Hill, New York, 1967, pp. 203-209. Detailed explanations on the indices will be presented later.

[8] See, for example, Peter J. Lloyd, *International Trade Problems of Small Nations*, Duke University Press, Durham, 1968, Chap. 1.

[9] Balassa shows whether a country's exports are more diversified or not by the standard deviation (σ in our Table 1). *Ibid.*, pp. 207-208.

TABLE 1. POPULATION, GDP, GDP PER CAPITA, AND INDICES OF EXPORT PERFORMANCE IN SIX INDUSTRIAL COUNTRIES

	a Population (million)	b GDP (billion $)	c GDP per capita (US $)	d Indices of Export Performance (E_W) arithmetic average (a)	standard deviation (σ)	coefficient of variation (v)
USA	186.6	502.1	2,691	84.0	55.3	0.65
Canada	18.6	35.1	1,887	85.0	179.9	2.11
Sweden	7.6	13.9	1,833	73.2	85.9	1.17
UK	53.4	77.6	1,454	106.0	49.6	0.46
EEC	173.2	216.5	1,250	107.7	28.7	0.26
Japan	94.9	52.3	551	110.9	110.5	0.99

Notes: a, b, c Data for the year 1962.
d Calculated for each country's exports to the world as regards 74 manufactured goods in 1960-62 averages.

ii) As shown also in Table 1, *per capita* incomes are the highest in the U.S. and the lowest in Japan, with the values for the other four countries being fairly similar in the order of Canada, Sweden, the U.K., and EEC.[10] It is proposed that the greater the similarity in the demand patterns (represented by the similarity of *per capita* income), the volume of trade and the intensity of trade in manufactures between those countries will be higher.[11] There is a counter proposal, however, that the greater the dissimilarity in factor endowments and stage of industrialization (represented by the difference in *per capita* income), the more intensive the trade between those countries will be due to greater difference in comparative cost structure.

iii) The closer geographical, cultural, historical, and political ties between two countries, the more intensive the trade between them will be.

Table 2 aims to examine propositions (ii) and (iii) via calculations for intensities of trade[12]

[10] We deal with these six countries as "industrial countries" and the rest of the world as "non-industrial countries" mainly because of statistical difficulties regarding the latter. The complexity of non-industrial countries taken together brings about a number of ambiguities for our analysis. The group of non-industrial countries consists of high income countries such as Australia, New Zealand and Scandinavian countries as well as less developed countries with very low incomes. It is assumed, however, that for each of the industrial countries the group of non-industrial countries is to be lower in income level by taking into account the trade relations between them.

[11] S. B. Linder, *An Essay on Trade and Transformation*, John Wiley & Sons, New York, 1961, pp. 94-99.

[12] The intensity of, say, Japan's export trade with another country is measured by the ratio of that country's share in Japanese exports to its total share in world imports. In symbols,

$$\frac{X_{ij}}{X_i} \Big/ \frac{M_j}{W-M_i} \times 100,$$

where X_{ij} stands for Japanese exports to country j; X_i for total Japanese exports ($=\sum_j X_{ij}$); M_j for total imports by country j; M_i for total imports by Japan; and W for total world imports. It might be argued that the denominator of $M_j/(W-M_i)$ should be W, instead of $W-M_i$. However, this does not seem valid since Japanese imports do not constitute a meaningful demand for Japanese exports. In the case of an aggregated trade such as for the EEC or other industrial groupings, the formula should be

$$\frac{X_{IJ}}{X_I} \Big/ \frac{M_J}{W-(M_I-M_{II})} \times 100,$$

where X_I and M_I stand for the total exports and imports of the industrial countries and M_{II} for the intraarea imports (=exports) in the group; consequently, M_I-M_{II} represents the imports of the industrial countries from the outside group.

TABLE 2. INTENSITY-OF-TRADE INDICES, 1960–62 AVERAGES

Exports from \ To	Japan	USA	Canada	UK	EEC	Sweden	*I*	*N*
Japan	—	256	38	25	16	22	63	133
USA	169	—	284	68	51	41	79	103
Canada	25	689	—	156	15	9	151	35
UK	42	72	82	—	63	104	62	128
EEC	37	63	12	65	106	91	91	76
Sweden	36	66	16	151	101	—	79	114
I	69	89	91	64	85	80	83	100
N	181	64	55	212	90	129	104	—

Source: United Nations, *Commodity Trade Statistics*, New York, 1960, 1961, 1962.
Symbols: *I*—six industrial countries taken together
N—non-industrial countries
Notes: Trade in manufactured goods among non-industrial countries is not included, but it is less than 5 per cent of the total world trade in manufactured goods.

in manufactured goods between six industrial countries as well as between these countries and non-industrial countries. Intensities are high in both directions of the trade between the U.S. and Canada, the U.S. and Japan, the U.K. and Sweden, and in the intraregional trade of the EEC. Besides, intensities are high in exports from Canada to the U.K. and from Sweden to the EEC. As regards trade with non-industrial countries, Japan, the U.K., and Sweden have high intensities in both directions, while the U.S. has high intensity only in her exports. These results suggest that special ties between two countries may be more influential than the similarity or dissimilarity of income levels upon determining the intensity of trade.

iv) In general, Japan has strong comparative advantages in manufacturing industries since she lacks natural resources and is at a comparative disadvantages in primary production. This is the reverse for Canada where, in order to maintain the balance of payments, indices of export performance (if indices are calculated so as to cover all trading commodities) appear low in manufactured goods.

The above-mentioned factors influence the level of the export performance index for each manufactured good in the various countries. These are not our concern in this paper, however. It is anticipated that the order of export performance index for each manufactured good may appear systematically along the line of the factor-proportions theorem. For example, the level of the export performance index for steel is higher in Japan than in the U.S., but rank of it in each country may be the opposite. This would result from the fact that Japan's comparative advantage is weak in capital-intensive goods relatively to the U.S.

III. *A Theoretical Model and Tools of Empirical Verification*

Let us suppose, as usual in international trade theory, a model of two countries, A and B, two commodities, x and y, and two factors of production, L (labour) and K (capital). First, we assume a fixed coefficient of inputs for each good (different for each good), but

common to both countries and, thus, we obtain the following result.[13]

$$\left(\frac{P_x}{P_y}\right)_A-\left(\frac{P_x}{P_y}\right)_B=C\left[\left(\frac{W}{R}\right)_A-\left(\frac{W}{R}\right)_B\right]\cdot\left[\left(\frac{K}{L}\right)_y-\left(\frac{K}{L}\right)_x\right] \quad \cdots\cdots(1)$$

where P_x/P_y stands for the relative price of x in terms of y, $\frac{W}{R}$ for the relative price of labour in terms of capital, and C for a constant coefficient.

If the relative wage in country A is lower than in country B and the production coefficient is more labour intensive in x-goods than in y-goods, or, in other words, if $\left(\frac{W}{R}\right)_A<\left(\frac{W}{R}\right)_B$ and $\left(\frac{K}{L}\right)_x<\left(\frac{K}{L}\right)_y$, the resulting comparative cost would be

$$\left(\frac{P_x}{P_y}\right)_A\Big/\left(\frac{P_x}{P_y}\right)<1 \quad \cdots\cdots(2)$$

This is the simplest presentation of the factor-proportions theorem: country A may be expected to have a comparative advantage in the production of x-goods requiring relatively large inputs of labour with lower relative wage (perhaps due to its more abundant endowment of labour)[14] and, correspondingly, a comparative disadvantage in the production of y-goods embodying its relatively expensive factor.

Furthermore, it can be said that the greater the difference in labour-intensity between the two industries, and the greater the difference in relative wages between the two countries, the larger the difference in comparative advantage structures will be. Our main interests in this paper are to show how regularly these propositions appear in the actual exports in manufactured goods from advanced industrial countries.

Propositions are to be presented more exactly by assuming production functions of a Cobb-Douglas type. The production function for any j-industry is supposed to be

$$O_j=A_jK_j^{\beta_j}L_j^{1-\beta_j} \quad (j=1, 2, \cdots, n) \quad \cdots\cdots(3)$$

where O stands for output, K and L for capital and labour, respectively, A for a constant coefficient, and β for capital's relative share, showing the fact that the larger β, the more capital intensive production will be. The order of commodities are so arranged that[15]

$$\beta_1<\beta_2<\cdots\beta_s<\cdots<\beta_n \quad \cdots\cdots(4)$$

The relative price of j-goods in terms of the numeraire goods, s, will be

$$\frac{P_j}{P_s}=\frac{A_s\cdot B_s}{A_j\cdot B_j}\cdot\omega^{\beta_s-\beta_j} \quad \cdots\cdots(5a)$$

or

$$\frac{P_j}{P_s}=\frac{1}{\left\{\frac{A_j\cdot B_j}{A_s\cdot B_s}\cdot\omega^{\beta_j-\beta_s}\right\}} \quad \cdots\cdots(5b)$$

where $B_j=\beta_j^{\beta_j}(1-\beta_j)^{1-\beta_j}$ and $\omega=\frac{W}{R}$. Since it is assumed that the production function of

[13] This is easily derived if we substitute the relationship, $P=WL+RK$, for the left-hand side of the equation (1).

[14] We set up the Heckscher-Ohlin theorem basing upon the difference in factor-price ratios rather than upon the difference in factor-endowments ratio between the two countries since the latter does not derive an unambiguous result if demand patterns (or tastes) vary in the two countries. On this point, see, Harry G. Johnson, *International Trade and Economic Growth*, George Allen & Unwin, London, 1958, Chapter 1, p. 25.

[15] It is assumed that no factor-intensity reversal would occur.

each goods is common for both countries, we obtain that[16]

$$\left(\frac{P_j}{P_s}\right)_A \Big/ \left(\frac{P_j}{P_s}\right)_B = \left(\frac{\omega_B}{\omega_A}\right)^{\beta_j-\beta_s} \quad \cdots\cdots(6)$$

This equation is showing, basically similar to equation (1), that the comparative advantage structure depends upon two elements: the ratio of relative wages between the two countries and the difference in capital intensities required for the production of two commodities. Therefore, we may derive the same propositions as mentioned above.

Now, in Fig. 1, let us plot ω_B/ω_A on the horizontal axis and $\frac{p_A}{p_B}=\left(\frac{P_j}{P_s}\right)_A \Big/ \left(\frac{P_j}{P_s}\right)_B$ on the vertical axis. Compared to a country J at 1 on the horizontal axis, a country with higher relative wages will be located at I or I' while a country with lower relative wages will be at N. Similarly, let numeraire good, s, in two countries A and B, where B has the higher relative wage, be at 1 on the vertical axis; other goods with lower comparative costs will lie below 1 while goods with higher comparative cost will lie above 1.

So far as a j-good is a less capital-intensive commodity than the s-good, (or, in other words, if $\beta_j-\beta_s<0$), we can draw, according to the equation (6), a curve like L which slopes downward towards the right. If the capital-intensity for another j-good is lower than in the

[16] Similar results are also derived by assuming a more general, linear and homogeneous production function. Let us assume the production function for i-goods as

$$X_i=F(K_i, L_i)=L_i f(k_i) \quad \cdots\cdots(i)$$

where

$$k_i=\frac{K_i}{L_i}, \qquad i=1, 2, \cdots, n.$$

Under perfect competition in factor markets, rewards to factors of production are equal to respective marginal products, or, in other words,

$$R=f_i'(k_i)$$

and

$$W=f_i(k_i)-f_i'(k_i)k_i.$$

Thus, the factor-price ratio will be

$$\omega=\frac{W}{R}=\frac{f_i(k_i)}{f_i'(k_i)}-k_i \quad \cdots\cdots(ii)$$

and the relative price ratio between i and j goods will be

$$\frac{P_j}{P_i}=\frac{f_j'(k_j)}{f_i'(k_i)} \quad \cdots\cdots(iii)$$

The derivative of the equation (iii) with respect to ω will result in

$$\left(\frac{P_i}{P_j}\right)\cdot\frac{d(P_j/P_i)}{d\omega}=\frac{1}{k_j+\omega}-\frac{1}{k_i+\omega} \quad \cdots\cdots(iv)$$

In so far as k_j is always larger than k_i at any value of ω

$$\frac{d(P_j/P_i)}{d\omega}<0 \quad \cdots\cdots(v)$$

This shows that the relative price of more capital-intensive goods is a decreasing function of the relative wages.

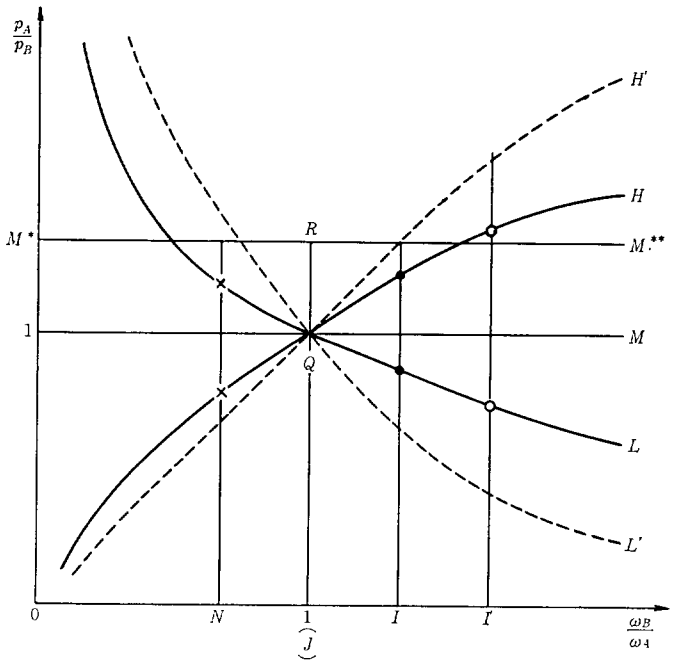
As the partial derivative of the equation (iv) with respect to k_j at a given (P_j/P_i), we obtain that

$$\frac{\partial}{\partial k_j}\left[\frac{P_i}{P_j}\cdot\frac{d\left(\frac{P_j}{P_i}\right)}{d\omega}\right]=-\frac{1}{(k_j+\omega)^2}<0 \quad \cdots\cdots(vi)$$

This shows that the larger the difference in factor-intensities between the two goods is, the more rapidly the relative price of more capital-intensive goods will fall when relative wages rise.

The relationship between relative prices of commodities and factor-intensity differences in a general n-goods case is also derived by R. W. Jones, "Factor Proportions and the Heckscher-Ohlin Theorem", *Review of Economic Studies*, Vol. XXIV (1), 1956-57, pp. 1-10.

FIG. 1 (for country J)



above case, the L' curve is drawn. Similarly, if $\beta_J - \beta_S > 0$, such curves as H and H' are derived.

Contrasting the comparative advantage (or disadvantage) of J-country vis-à-vis the higher relative-wage countries, say, along the curves L and H, it is clear that J-country has a comparative advantage in labour-intensive goods, L, and a comparative disadvantage in capital-intensive goods, H. Moreover, the advantage (or disadvantage) is greater for J-country vis-à-vis the much higher relative-wage country, I', than vis-à-vis the less higher I. This is equally applicable to the relationship of a country vis-à-vis lower relative-wage countries (only a country N being shown in Fig. 1) except that the comparative advantage or disadvantage for commodities becomes reversed. These illustrate the *country-wise structure of comparative advantage*.

To compare the L-curve with the L'-curve (or the H-curve with the H'-curve), and it becomes clear that the greater the difference in capital-intensities of certain production relative to the numeraire good, the stronger the comparative advantage (or disadvantage) will be. This illustrates the *commodity-wise structure of comparative advantage*.

One modification of Fig. 1 is required in connection with our empirical study. Our investigations are confined to the exports of manufactured goods from various countries, neglecting manufactured imports and trade in primary produce. As mentioned in Section I, exports in some countries consist mainly of manufactured goods while in other countries more than half of exports are primary products. These differences are to be taken into account.

Let us add to Fig. 1 an auxiliary horizontal line, M^*RM^{**}, above the line $1QM$. The new line means that, whereas J-country with which we are concerned was able to export

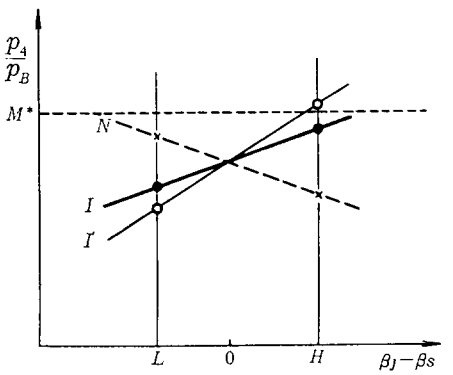
those manufactured goods whose comparative costs were less than 1, it is now able to export manufactured goods even if their comparative costs are more than 1 but less than M^* (say, 1.2 or 1.5).

This would be admitted for the numeraire manufactured good, s, which has no comparative advantage or disadvantage among manufactured production, but which still has a comparative advantage relative to primary production in the whole comparative advantage structure of an economy. The location of the M^* line relative to 1 depends upon the general strength of comparative advantage in manufacturing industries vis-à-vis that of primary production. Thus the value of M^* for Japan would be much higher than 1 whereas that for Canada might be lower than 1.[17]

The introduction of an auxiliary line will not affect the results of our investigation since that would change the value of the comparative advantage of each manufactured export, but would not change the structure, (or the order), our main concern here.

As a result of the above modification, country J is able now to export somewhat capital-intensive goods even to a higher relative-wage country (e.g., H-goods to country I, but not to country I') and labour-intensive goods even to a lower relative-wage country (e.g., L-goods, but not L'-goods, to country N).

FIG. 2 (for country J)



From Fig. 1 we can derive Fig. 2 in which the difference in capital-intensities of an industry relative to the numeraire industry ($\beta_J-\beta_s$) is measured on the horizontal axis. Since L-goods are less capital-intensive while H-goods more capital-intensive than the numeraire goods, s, the former shifts to the left, while the latter to the right, of point 0. Vis-à-vis Fig. 1, it is clear from Fig. 2 that country J's exports of manufactured goods to the higher relative-wage countries (I and I') are shown by curves with a positive slope while those to the lower relative-wage country (N) by a curve with negative slope. Moreover, the slope is steeper in the exports to the much higher relative-wage country (I') than in those to the less high relative-wage country (I). This is equally applicable in the case of exports to lower relative-wage countries if more than two countries are involved.

[17] The value of M^* for a country may vary according to different partner countries concerned if trade policies are carried out in such a way as to enforce the maintenance of *bilateral* balance of payments. Various factors which affect the value of comparative advantage or the intensity of trade mentioned in Section II will also have an influence upon the value of M^*.

From these examinations, we can derive now the following four propositions.

Proposition 1: the structure of comparative advantages of a country vis-à-vis the lower relative-wage countries is to be strong in capital-intensive goods and weak in labour-intensive goods.

Proposition 2: the structure of comparative advantages of a country vis-à-vis the higher relative-wage countries is to be strong in labour-intensive goods and weak in capital-intensive goods.

These are basic proportions in line with the Heckscher-Ohlin theorem. In the case that a country exports to two markets, as a combination of the above two propositions, the following will apply.

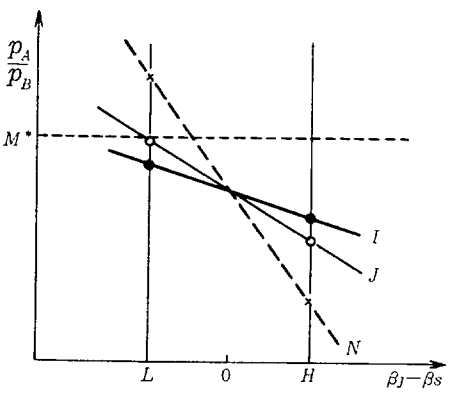
Proposition 3: If one of the two markets belongs to the higher relative-wage group while the other to the lower one, the country's exports show a *dualistic* structure of comparative advantages which are mutually symmetric in the two markets.

Proposition 4: If the two (or many) markets belong to the higher (or the lower) relative-wage group, the country's structure of comparative advantages to each market is to be similar and *non-dualistic*, although the closer the relative-wage of the two markets, the more similar the country's structure of comparative advantages will be, and *vice versa*.

These two may be called propositions of *duality* or *non-duality* in a country's exports to various markets.

A figure similar to Fig. 1 in which country J was concerned is drawn for other countries by shifting the point Q in Fig. 1 to the left, or to the right according to the relative wage of the country concerned. In the case for country I', for example, the point Q falls on a vertical line originating from the point I' and accordingly all the curves, L, L', H and H', are moved rightwards. From this figure, we may be able to drive Fig. 3 for country I'. Since the country I' is the highest in its relative-wage among countries with which we are considered, all the curves in Fig. 3 have negative slopes, showing that its structure of comparative

FIG. 3 (for country I')



advantages is strong in capital-intensive goods and weak in labour-intensive goods in all markets.

Fig. 2 and Fig. 3 make it possible to contrast the comparative advantage structures of two countries to a third market, giving rise to the following propositions.

Proposition 5: If the relative-wage of the third market (say, country I) is between the two exporting countries (say, country J shown by Fig. 2 and country I' shown by Fig. 3), the comparative advantage structures of the two exporting countries are symmetric or *complementary* with each other in respect to the common, third market.

Proposition 6: If the relative wages of the two exporting countries (say, country I' and J) is higher (or lower) than that of a third market (say, country N), the comparative advantage structures of the two exporting countries are similar or *competitive* to each other in respect to the common, third market.

These may be called propositions of *complementarity* or *competitiveness* between exports of two (or many) countries in respect to a third market.

Finally, it is of interest to compare curve I' in Fig. 2 with curve J in Fig. 3. Such a comparison enables us to derive propositions of a *vertical-trade type* or *horizontal-trade type* in bilateral exports.[18]

Proposition 7: If there is a substantial difference in relative-wages between two countries, the comparative advantage structures of mutual exports between them are to be symmetric with each other or of a *vertical-trade type*.

Proposition 8: If two countries have a fairly equal relative-wage, the comparative advantage structures of mutual exports between them are to be similar to each other or of a *horizontal-trade type*.

In the case of vertical-trade, bilateral exports are carried out mainly between different commodity categories; for horizontal trade, bilateral exports are carried out within the similar commodity category.[19]

To do empirical studies, first, we substitutes export performance indices for the comparative advantage structures, or $\frac{p_A}{p_B}=\left(\frac{P_J}{P_S}\right)_A\Big/\left(\frac{P_J}{P_S}\right)_B$ shown on the vertical axis of our previous figures. This is justified since "comparative advantage would be expected to determine the structure of exports,"[20] or, in other words, the export performance of individual countries is thought to be "revealed" comparative advantages.

Indices of relative export performance[21] are calculated by dividing (a), the share of a country's exports of a given commodity to a certain market in its total exports of manufactured goods, by (b), the share of that market as regards that commodity in the combined exports of manufactured goods of the six industrial countries under consideration, and expressing the results in index number form. Thus, for a given export commodity, h, of a particular country, i, to a certain market, j, an index number of 110 will mean that the country i's comparative advantage in this commodity h's exports to the market j is 10 percent higher than the comparative advantage of industrial countries taken together vis-à-vis this market.

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[18] As regards propositions 7 and 8, some qualifications may be required as will be explained later in Section V.

[19] If the bilateral exports have similar structures, they might be called "competitive." Even in this case, however, a country's exports might be complementary with the import-demand structure in the partner country. We would like to reserve the terms of complementarity or competitiveness to describe the relation either between one country's exports and the partner country's imports, or between two countries' exports to a third market as shown in Propositions 5 and 6.

[20] Bela Balassa, *Trade Liberalization Among Industrial Countries*, McGraw-Hill, New York, 1967, p. 203.

[21] Indices are alternatively called as indices of "relative shares." Bela Balassa, *ibid.*, p.204.

In symbols,

$$E_{ij}^{h}=\frac{X_{ij}^{h}}{X_i}\Big/\frac{X_{Ij}^{h}}{W_I}\times 100,$$

where E_{ij}^{h} stands for the export performance index of country i's exports of commodity h to country j; X_{ij}^{h} for country i's exports of commodity h to country j; X_i for country i's total exports of manufactured goods ($=\sum_j\sum_h X_{ij}^{h}$); X_{Ij}^{h} for combined exports of commodity h of the six industrial countries under consideration; and W_I for the total exports of all the manufactured goods of six industrial countries to the world ($=\sum_j\sum_h X_{Ij}^{h}$).[22]

We might now ask how well the export performance indices reveal the comparative advantage structures. This may be justified because the lower the potential comparative cost of a certain exportable commodity in a particular country, the greater the revealed height of indices will be as compared with other commodities in a multi-country world, provided that the price elasticity of export-supply of any commodity is thought to be the same for all the industrial countries (this assumption being admitted to be true by our previous assumption of common production functions), and that import-demands of all countries are elastic with respect to price.

Indices of export performance are calculated for exports of seventy-four manufactured goods from the United States, Canada, the European Common Market (counted as a unit), the United Kingdom, Sweden, and Japan on the basis of 1960–62 averages. These countries, the largest exporters of manufactured goods, account for more than four-fifths of world exports of manufactures. We have obtained, in total, 49 series of export performance indices, each for 74 commodities, consisting of the exports of each of the six industrial countries to the other five, to the world, (W), to industrial countries group (I), to non-industrial countries group (N), and intra-EEC exports.

Following Balassa, "manufactured goods have been defined to include the products classified in commodity categories 5 to 8 of the SITC, less unwrought metals. With respect to these products, I have attempted to establish a commodity classification based on substitution possibilities in production. The point of departure has been the three-digit breakdown of the SITC; this has been supplemented by a four-digit breakdown whenever it appeared necessary and was made possible by the availability of statistical information."[23] Thus, altogether seventy-four commodity categories have been distinguished.

Second, we need to know the relative wage (W/R ratio) for the six industrial countries

[22] In the case when the world market is divided into industrial and non-industrial markets, the export performance index of country i is to be, respectively,

$$E_{iI}^{h}=\frac{X_{iI}^{h}}{X_i}\Big/\frac{X_{II}^{h}}{W_I}\times 100,$$

and $$E_{iN}^{h}=\frac{X_{iN}^{h}}{X_i}\Big/\frac{X_{IN}^{h}}{W_I}\times 100.$$

The total of the above two makes country i's index with respect to its exports to the world:

$$E_{iW}^{h}=\frac{X_{iW}^{h}}{X_i}\Big/\frac{X_{IW}^{h}}{W_I}\times 100,$$

where $X_{iW}^{h}=X_{iI}^{h}+X_{iN}^{h}$ and $X_{IW}^{h}=X_{II}^{h}+X_{IN}^{h}$.

There is such a relationship that E_{iW}^{h} will come always in between E_{iI}^{h} and E_{iN}^{h}, since

$$E_{iW}^{h}=\frac{X_{II}^{h}}{X_{IW}^{h}}\cdot E_{iI}^{h}+\frac{X_{IN}^{h}}{X_{IW}^{h}}\cdot E_{iN}^{h}.$$

[23] Bela Balassa, *ibid.*, p. 204.

and the non-industrial countries group. We simply assume that the order of relative wages in the six industrial countries is represented by the *per capita* incomes shown in Table 1 and that the order of the non-industrial countries group is lower than each of the industrial countries under consideration. This implies that the difference in wage levels of various countries corresponds to *per capita* incomes and the former corresponds to relative wage (W/R ratio) since capital moves more freely resulting in roughly equal prices in those countries under consideration. Even if the difference in the price of capital is taken into account, since it usually is lower in higher wage countries and higher in lower wage countries, the difference in relative wages would be larger than in wage levels (and *per capita* incomes), but their order would not be changed. In short, for our investigation only the order of relative wages in various countries is known, and we do not need absolute values.

Third, it is assumed in the theoretical model that the production function of each commodity is the same for various countries concerned and that factor-intensity reversals between countries do not occur. This factor intensity assumption should be tested to complete our empirical work, but was not done here due to time limitations. However, Lary has clearly shown that "the ranking of industries by factor intensities is much the same from country to country, even from the most developed to the least developed. That is to say, the phenomenon of factor-intensity reversals seems to be much less common, at least in manufacturing, than some other empirical studies would suggest."[24,25]

Our empirical study will be carried out using two approaches. The first is an empirical illustration of the factor proportions theorem where we have tried to draw charts similar to Fig. 2 and 3, using export performance indices. This will prove Propositions 1 and 2. It is noted that the vertical axis in the charts is the reverse of that of Figs. 2 and 3; the lower the comparative cost in Fig. 2 and 3, the higher the export performance index in charts will be.

The second is the more rigorous verification of the factor-proportions theorem. Propositions 1 and 2 are basic and the remainder (Propositions 3 to 8) are corrolaries which are admitted to be true if the basic propositions are proved. If the remainder are rigorously proved to be true, this would certainly make the verification of basic propositions more sound.

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[24] Hal B. Lary, *Imports of Manufactures from Less Developed Countries*, National Bureau of Economic Research, New York, 1968, p. 19. Charts 8-10 shown on pages 67-69 are most impressive. As regards 13 industry groups of 9 countries (the U. S., Canada, Australia, Sweden, the U. K., Japan, Brazil, Mexico, and India), total value added per employee is compared and both Kendall's coefficient of concordance (0. 853) and the chi-square test (92. 12) are very significant (*Ibid.*, p. 71). GATT presented a similar but more fragmentary analysis and concluded that "the substantial differences existing in the average wage rates prevailing in various countries, principally as a result of unequal degree of economic development, are likely to correspond to actual differences in costs of production." GATT, *International Trade for 1964*, Gèneva, 1965, p. 16.

[25] Bagicha S. Minhas presented specific evidence supporting the possibility of factor-intensity reversals between countries, in his book, *An International Comparison of Factor Costs and Factor Use*, Amsterdam, 1963. 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, and indicated that the phenomenon of factor-intensity reversals becomes a good deal less common than first appeard, once the comparison is limited to manufacturing industry and based on direct factor inputs only. (Gary Hufbauer, *Synthetic Materials and the Theory of International Trade*, Duckworth, London, 1966, Appendix B. David Ball, "Factor-Intensity Reversals in International Comparison of Factor Costs and Factor Use," *Journal of Political Economy*, February, 1966.)

The verification of Propositions 3 to 8 is done by obtaining rank-correlation between two series of export performance indices. This will enable us to show whether the structure of comparative advantages between two countries under consideration is symmetric or similar even without any information of factor intensities of various industries.

IV. *Empirical Illustrations of the Factor-Proportions Theorem*

The factor proportions theorem will be empirically supported if charts similar to those of the theoretical model are obtained from the actual 1960–62 export-performance indices. First, seventy-four manufactured exports are classified into two broad commodity categories: *L*-goods consisting of 35 light manufactures or *H*-goods consisting of mainly heavy manufactures, chemicals and a small number of wrought metals.[26] It may not be unreasonable to suppose that *L*-goods are more labour-intensive than *H*-goods.[27]

Within each of the two broad commodity categories, five commodities are selected centered about the item which is ranked at a quater from the highest (or from the lowest) in the range of export performance indices for each of *L*- and *H*-goods in the Japanese data. They are called "Top-group" and "Bottom-group."[28] This is done on the assumption[29] that, within

[26] By SITC code number, the *L*-good covers 541, 611, 612, 613, 621, 629.1, 629.0, 642, 651.2, 651.3, 651.4, 651.6,7, 652, 653.2, 653.5,6,8, 653.0, 654, 655, 656.6, 656.0, 657, 665, 666, 691–8, 733, 812, 821, 831, 841, 842, 851, 861, 862, 891, 897;
while the *H*-good covers 664, 671, 673, 674, 675, 676, 678, 711, 712.0, 712.5, 714, 715, 717.1, 718.9, 722.1, 72.0, 731, 732.1,6, 732.2,5,7, 732.8, 734, 735, 512, 513.4,5, 531, 533, 551, 553.4, 561, 571, 581, 599, 641, 682.2, 683.2, 684.2, 685.2, 686.2, 687.2.

[27] Hal B. Lary's detailed study of value added per employee for 178 manufactured goods (*Imports of Manufactures from Less Developed Countries*, National Bureau of Economic Research, New York, 1968, Appendix *B*, pp. 168–178) is classified into *L*-goods and *H*-goods. The average of value added per employee (i.e., an index of capital intensity) in Japan and the U.S., for the year 1962 is as follows:

(dollars)

	Japan	USA
L-goods	1,838	8,375
H-goods	4,020	14,154

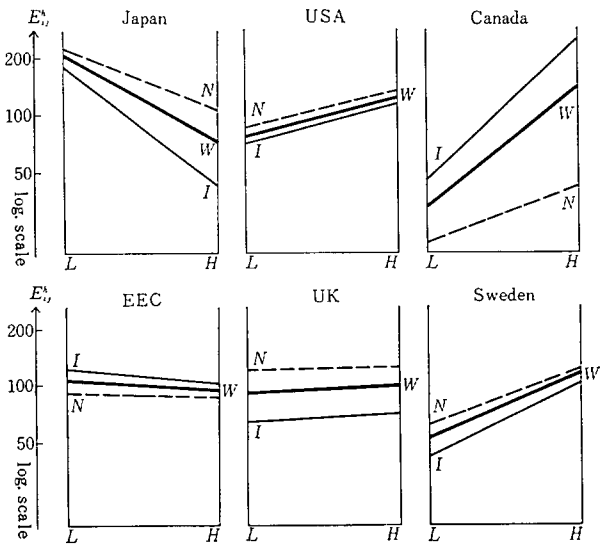
[28] Commodity items belonging to each group are as follows:
Top-group in *L*-goods: Clothing (841 in SITC), Blankets (656.6), Travel goods, Handbags (831), Tulle, Lace, Embroidery (654), Special textile fabrics (655).
Bottom-group in *L*-goods: Musical instruments (891), Glassware (665), Articles made of paper (641), Materials of rubber (621), Manufactures of leather (612).
Top-group of *H*-goods: Textile machinery (717.1), Iron & Steel bars (673), Buses, lorries, trucks (732.2, 5, 7), Electric power machinery (722.1), Plastic materials (581).
Bottom-group of *H*-goods: Perfumery & cosmetics (553, 4), Pigments, paints, varnishes (533), Metal-working machinery (715), Automobiles (732.1,6), Chemical material & products (599).

[29] We may select a number of single commodity categories, for example, textiles and steels. An international comparison between these is of interest for certain purposes, but cannot be devoid of some arbitrariness, depending upon the specific country's situation; for example, some countries may concentrate exceptionally in exports of textiles while others may not export steel.

each broad commodity category, the top-group will tend toward more labour-intensive commodities while the bottom-group to more capital-intensive commodities.[30] Such an assnmption is justified if the phenomenon of factor-intensity reversals does not occur as Lary, Hufbauer and Ball show.

The comparison between *L*- and *H*-goods is first shown for exports of each of the six industrial countries to the world, *W*, to the industrial countries group, *I*, and to non-industrial countries group, *N*, (Chart 1), and second for trade between each of the six industrial countries (Chart 2). For example, a line denoted *W* for Japan in Chart 1 shows the fact that the average of export performance indices for 35 *L*-goods (190) is higher than

CHART 1. A COMPARISON OF EXPORT PERFORMANCE INDICES (E_{ij}^{h}) BETWEEN *L*- AND *H*-GOODS: EXPORTS FROM EACH OF SIX INDUSTRIAL COUNTRIES TO THE WORLD, TO INDUSTRIAL COUNTRIES, AND TO NON-INDUSTRIAL COUNTRIES



Symbols *W*: exported to the world
I: exported to the industrial countries
N: exported to the non-industrial countries

[30] Again, according to the study done by Lary, *ibid.*, the average of value added per employee for each commodity category is as follows:

(dollars, 1962)

	Japan	U. S.
Top-group of *L*-goods	1,742	6,802
Bottom-group of *L*-goods	1,968	9,797
Top-group of *H*-goods	3,174	12,643
Bottom-group of *H*-goods	3,827	17,107

that for 39 *H*-goods (70). A negatively sloped line shows that a country has stronger comparative advantage vis-à-vis a certain market in labour-intensive goods than in capital-intensive goods while a positively sloped line shows the reverse. Let us label, for the sake of briefness, the former the "pro-labour-intensive" type and the latter the "pro-capital-intensive" type.

Chart 1 depicts a regular pattern of export performance of each of the six industrial countries which is consistent with our theoretical expectations as shown by the following.

(i) Since Japan and the EEC fall in the lower income group among the six industrial countries, they show a pro-lebour-intensive type while the other four countries show a pro-capital-intensive type for they belong to a higher incomes group.

(ii) The negative slope for Japan is steeper than that for the EEC, whereas the positive slope for the U.S. is steeper than that for the U.K. This means that the *H*/*L* ratio of export performance indices increases in the order of Japan (0.37), the EEC (0.88), the U.K. (1.04), and the U.S.A. (1.52) as regards their exports to the world in correspondence to the order of incomes *per capita* of the four countries. In other words, the lower the income level of a country, the more pro-labour-intensive the country will be; the higher its income level, the more pro-capital-intensive the country will be.

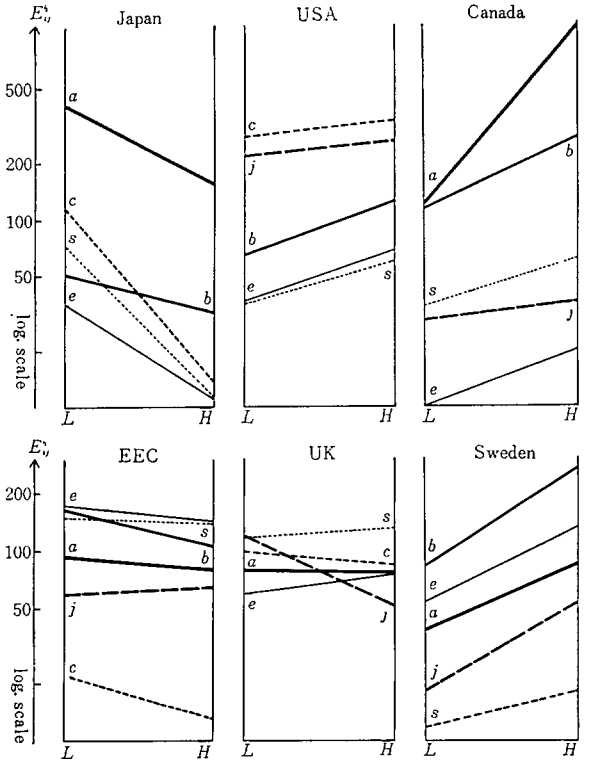
The positive slopes of the lines for Sweden and Canada are more positive slopes than those for the U.S. These exceptions may be due to the fact that these two countries have small economies and must specialize heavily in a limited number of *H*-goods, as explained already in Secton II.

(iii) It might be thought contradictionary to our theoretical expectation that the exports of Japan and the EEC to non-industrial countries is of a pro-labour-intensive type, even though incomes *per capita* are thought to be higher in the former. This contradiction appears from the fact that, while in our model all the countries concerned are assumed to produce and export all the manufactured goods under consideration, the non-industrial countries group exports practically no (or a very small amount of) manufactured goods. For the most part this group can be considered a market for industrial countries' exports. In such a case, the pattern of export performance from each industrial country is not influenced by the comparative advantage structures between each of them and the non-industrial countries group (the comparative advantage being virtually non-existence as far as only manufactured goods are taken into account), but it is determined by competition among the six industrial countries. Therefore, the phenomenon in question only appears contradictory because of the limitations of the theoretical model which does not cover the case of the non-production of manufactured goods in the partner country. Some regularity along the line of our theoretical expectation is still shown in the fact that the *H*/*L* ratio of export performance indices is higher in Japan's exports to the non-industrial countries group (0.44) than in those to the industrial countries group (0.24) and that the corresponding ratio for the EEC is 0.94 and 0.83, respectively. These comparisons will be done more exactly by the rank-correlation analysis in the following Section V.[31]

Chart 2 shows also regular patterns of export performance among industrial countries

[31] As regards Chart 1, one further point may be added. As mentioned in previous footnote 22, p. 11, the *W*-line falls between the *I*- and *N*-lines. Whether the *I*-line lies above or below the *N*-line depends upon the relative closeness of trade relationships with the industrial countries group or the non-industrial countries group. However, this point does not have any important theoretical implications for the present paper.

CHART 2. A COMPARISON OF EXPORT PERFORMANCE INDICES (E_{ij}^h) BETWEEN L- AND H-GOODS: TRADE BETWEEN EACH OF SIX INDUSTRIAL COUNTRIES



Symbols a: exported to the U. S. A. b: exported to the U. K.
c: exported to Canada e: exported to the EEC
j: exported to Japan s: exported to Sweden

which follow the Propositions 1 and 2 as shown by the following.

(i) Japan is the lowest in incomes *per capita* among the six industrial countries and her exports to the other five countries are, without exception, of a pro-labour-intensive type.

(ii) The U.S.A. is the highest in incomes *per capita* and, symmetrically to Japan, her exports to the other five countries are regularly of a pro-capital-intensive type.

(iii) Since the EEC is the second lowest in incomes *per capita*, the pro-labour-intensive type appears in its exports to the U.S., Canada, Sweden, the U.K., and in intra-EEC trade whereas the pro-capital-intensive type is seen only in its exports to Japan, whose income level is lower than her own.

(iv) The U.K. is the third lowest in income *per capita*. Her exports to countries with incomes higher than herself (such as the U.S. and Canada) are of a pro-labour-intensive type consistent with the Propositions, but her exports to Sweden is of a pro-capital-intensive type in contradiction to the Propositions. This contradiction may be due to the fact that Sweden

is small in economic size and highly specialized in a limited number of manufactured products. In the case of lower income countries the U.K.'s exports to the EEC are of a pro-capital-intensive type while exports to Japan are of a pro-labour-intensive type. Although the latter phenomenon (in relation to Japan) contradict to the Propositions, this may be due to a special reason of fairly large exports of woolen manufactures from the U.K. to Japan.

(v) The exports of both Canada and Sweden are of a pro-capital-intensive type in all directions. This may involve a contradiction since the income *per capita* in the U.S. is higher than in these two countries. This contradiction may be due to the characteristics of small and more specialized economies, and especially to the fact that paper and paperboard (SITC Code No. 641), their major export items, are classified as *H*-goods in the sense that those

TABLE 3. A COMPARISON OF EXPORT PERFORMANCE INDICES (E^h) BETWEEN TOP AND BOTTOM GROUPS FOR *L*- AND *H*-GOODS: EXPORTS FROM EACH OF SIX INDUSTRIAL COUNTRIES TO THE WORLD, TO INDUSTRIAL COUNTRIES, AND TO NON-INDUSTRIAL COUNTRIES

		L-goods			*H*-goods		
Exports from \ To		*W*	*I*	*N*	*W*	*I*	*N*
Japan	*T*	236.0	150.6	296.5	91.2	29.7	127.2
	B	76.1	65.0	85.9	20.0	4.1	33.8
	T/B	3.10	2.32	3.45	4.56	7.24	3.76
EEC	*T*	128.0	150.0	108.6	108.5	132.3	99.2
	B	122.5	136.2	109.6	100.8	108.6	95.2
	T/B	1.04	1.10	0.99	1.08	1.22	1.04
UK	*T*	80.5	59.2	102.1	111.5	72.4	135.7
	B	100.8	69.2	131.0	131.1	94.2	159.1
	T/B	0.80	0.86	0.77	0.85	0.77	0.85
USA	*T*	37.7	37.2	40.6	90.8	88.7	82.1
	B	79.6	80.7	79.0	120.5	134.1	108.9
	T/B	0.47	0.46	0.51	0.75	0.66	0.75
Sweden	*T*	40.3	26.4	54.5	86.9	86.7	86.3
	B	64.4	42.8	84.0	45.6	41.9	49.0
	T/B	0.63	0.62	0.65	1.91§	2.07§	1.76§
Canada	*T*	23.2	30.1	15.7	37.4	62.5	21.3
	B	27.6	31.4	22.4	29.8	41.3	20.5
	T/B	0.84	0.96	0.70	1.26§	1.51§	1.04§

Symbols *W*: exported to the World
I: exported to Industrial Countries
N: exported to Non-Industrial Countries
T: Top-group
B: Bottom-group
§: Seemingly Exceptional Cases

TABLE 4. A COMPARISON OF EXPORT PERFORMANCE INDICES (E^h) BETWEEN TOP AND BOTTOM GROUPS FOR L- AND H-GOODS: TRADE BETWEEN EACH OF SIX INDUSTRIAL COUNTRIES

Exports from \ To		*L*-goods						*H*-goods					
		Japan	EEC	UK	USA	Sweden	Canada	Japan	EEC	UK	USA	Sweden	Canada
Japan	T	—	24.2	35.7	366.8	17.7	216.6	—	6.2	5.0	199.1	0.8	16.4
	B	—	3.8	40.2	283.5	0	33.6	—	1.4	1.0	43.7	0	0
	T/B	—	6.37	0.89§	1.29	?	6.45	—	4.43	5.00	4.56	?	?
EEC	T	135.3	189.4	178.7	117.5	170.7	33.8	67.9	158.2	129.9	120.7	151.8	23.2
	B	34.4	174.3	156.7	122.5	157.9	23.3	47.1	134.4	134.2	117.7	131.9	17.6
	T/B	3.93§	1.09	1.14	0.96	1.08	1.45	1.44§	1.18	0.97	1.03	1.15	1.32
UK	T	54.6	43.8	—	91.3	107.2	126.5	138.1	69.2	—	107.6	127.3	73.1
	B	36.5	57.4	—	102.8	111.9	80.9	53.8	93.3	—	147.7	148.9	119.3
	T/B	1.50§	0.76	—	0.89	0.96	1.56	2.57§	0.74	—	0.73	0.85§	0.61§
USA	T	123.0	15.6	47.2	—	14.3	201.8	178.2	52.3	92.5	—	41.2	318.6
	B	244.6	38.7	76.5	—	41.3	308.6	290.0	91.6	136.9	—	65.7	303.3
	T/B	0.50	0.40	0.62	—	0.35	0.65	0.61	0.57	0.68	—	0.63	1.05
Sweden	T	0	25.4	50.8	23.3	—	1.2	122.2	95.8	290.7	83.3	—	10.0
	B	0	47.0	87.4	53.5	—	4.6	8.0	42.2	73.1	86.3	—	10.1
	T/B	?	0.54	0.58	0.44§	—	0.26	15.25§	2.27§	3.98§	0.97	—	0.99
Canada	T	0	1.4	76.3	108.1	1.5	—	0	8.6	249.3	283.2	9.0	—
	B	0	0	130.5	135.3	0	—	8.1	4.5	96.0	460.2	3.2	—
	T/B	?	?	0.58	0.80§	?	—	?	1.91§	2.60§	0.62	2.81§	—

Symbols T: Top-group
B: Bottom-group
§: Seemingly Exceptional Cases

items are more capital-intensive goods.

In short, the above test employing the L- vs. H-goods comparison well suports, with practically no exception, the basic Propositions 1 and 2 of the factor-proportions theorem.

In the case of Top- vs. -Bottom comparison, charts similar to Charts 1 and 2 are easily derived, but this time our results are shown in Tables 3 and 4. These tables are read so that if the T/B ratio of export performance indices is greater than 1, it is of a pro-labour-intensive type while if it is smaller than 1, it is of a pro-capital-intensive type.

In Table 3, Japan's exports of L-goods (as well as H-goods) to the world (W), to the industrial countries group (I), and to the non-industrial countries group (N) are of a distinctly pro-labour-intensive type. All the EEC's exports are also of a pro-labour-intensive type, although the T/B ratios are close to 1 and smaller than in the case of Japan. Exports of the U.S. and the U.K. in all directions are of a pro-capital-intensive type, the degree of which is more distinct for the U.S. than the U.K.

In Sweden and Canada, the exports of L-goods are of a pro-capital-intensive type as was

expected for these higher income countries. The degree of pro-capital-intensity is more significant in Sweden than in the U.K.; Canada is fairly close to the U.K.

All these phenomena are consistent with our Proportions. But, exports of *H*-goods in Sweden and Canada are of a pro-labour-intensive type even though they are higher incomes countries. This might seem contradictory, but the degree of pro-labour-intensity in Sweden and Canada falls between Japan and the EEC. Thus, it may be interpreted in such way that, even though Sweden and Canada are higher income countries, they are latecomers in heavy industrialization as are Japan and the EEC, and these four countries have similar structures of comparative advantage in exports of *H*-goods in clear contrast to the U.S. and the U.K.

In Table 4, exports of *L*-goods and *H*-goods between industrial countries show similar, but more subtle, relationships as seen in Table 3. Since almost all trends are consistent with Proportions 1 and 2, let us mention only cases which appear to be exceptional.[32]

Exceptional trends appear, first, in connection with Japan. Japan's exports of *L*-goods to the U.K. are pro-capital-intensive (the T/B ratio being 0.89); exports of *L*-goods from the U.K. and the EEC to Japan are pro-labour-intensive (1.50 and 3.93 respectively); exports of *H*-goods from the EEC, the U.K. and Sweden to Japan are pro-labour-intensive (1.44, 2.57, and 15.25 respectively).

Second, exceptional trends appear in connection with Sweden and Canada. Exports of *L*-goods from Canada and Sweden to the U.S. are pro-capital-intensive (0.80 and 0.44 respectively); Canada's exports of *H*-goods to the EEC, the U.K., and Sweden are pro-labour-intensive (1.91, 2.60, and 2.81 respectively); similarly, Sweden's exports of *H*-goods to the EEC and the U.K. (also to Japan as mentioned above) are pro-labour-intensive (2.27 and 3.98 respectively); and exports of *H*-goods from the U.K. to Canada and Sweden are pro-capital-intensive (0.61 and 0.85 respectively).

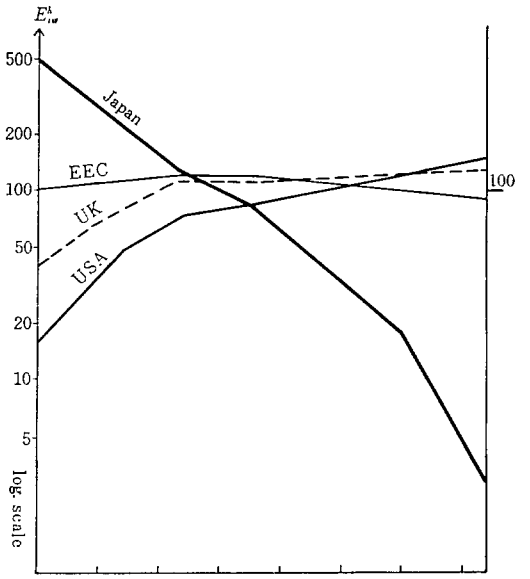
It is interesting to find that all the exceptional trends are concerned with Japan, Sweden and Canada which are highly specialized in limited lines of manufactured exports due to the fact that they are late starters in modern industrialization and, in the case of Sweden and Canada, smaller economies. Here we should recall our comments in connection with the non-industrial countries group. From these two cases we might infer that it is necessary to select countries whose production is more diversified and mutually homogeneous by excluding countries of specialization types in order to apply satisfactorily the model of factor-proportions theorem to world trade. If this short-coming of the theorem is taken into account, the results we obtained above can be considered as supporting the theorem.

V. *Rank-correlation between Series of Export Performance Indices*

Since basic Propositions 1 and 2 are supported well in the previous section, Propositions 3 to 8, will be automatically verified. The examination of rank-correlation co-efficients between two series of export performance indices is most suitable for our purpose since the order, not the height, of export performance reveals comparative advantage structure. The ranking of export performances is compared, first, between exports of two countries to a third market in order to prove Propositions 5 and 6; second, between exports of a country to two different

[32] We did not consider exceptional cases where the divergence of the T/B ratio fell within a few percentage points of 1.

CHART 3. AN IMPRESSIONISTIC PICTURE OF EXPORT PERFORMANCE INDICES IN EXPORTS FROM JAPAN, THE EEC, THE UK, AND THE USA TO THE WORLD



Note: Exports include 74 commodities arranged in order from higher to lower indices of export performance in Japan.

markets in order to prove Propositions 3 and 4; and, third, between mutual exports of two countries with the aim of proving Propositions 7 and 8. In addition, the test of Kendall's coefficient of concordance[33] is tried.

Chart 3 provides an impressionistic picture for the comparative advantage structures of Japan, the EEC, the U.K., and the U.S.A. shown in their exports of manufactured goods (74 items) to the world. Here commodities are arranged on the horizontal axis in order (from higher to lower) of Japan's performance indices.[34] Because of this, the curve for Japan[35] is smooth with a negative slope. For the EEC, the U.K., and the U.S.A. small deviations are smoothed out free-hand. The deviations for Sweden and Canada are so large because of their small economic size and specialization that curves for the two countries are omitted in the chart.[36]

[33] See M. G. Kendall, *Rank Correlation Methods*, Griffin, London, 1955, Chaps. 6-7; Sidney Siegel, *Nonparametric Statistics for the Behavioral Sciences*, New York, 1956, pp. 229-239.

[34] An alternative for arranging the order of commodities would be to base it upon the U. S. indices of export performance since Japan and the U. S. are the lowest and the highest, respectively, in income *per capita* among the six industrial countries under consideration.

[35] This is a picture for 1960-62 averages, and, it may be noted, Japan has experienced since then a rapid heavy industrialization and increase in income *per capita* ($995 in 1967 as compared with $551 in 1962).

[36] In the following analysis, too, our comparison is mainly concerned with the four larger industrial countries, Japan, the EEC, the U. K., and the U. S. A.

It is most interesting to see in the chart, first, that curves for Japan and the USA are regularly symmetrical. Second, the U.K. follows the pattern of the U.S., but with a more mildly positive slope. Thirdly, the curve for the EEC is almost flat, showing well the diversified structure of export performance, but it has a mildly positive slope up to the middle of the entire curve which is symmetrical to that of Japan; in the second half of the curve it has a mildly negative slope similar to that of Japan. These relationships, symmetrical or not, can be examined more exactly by concordance analysis.[37]

TABLE 5. COEFFICIENTS OF CONCORDANCE IN EXPORT-PERFOMANCE INDICES: EXPORTS FROM INDUSTRIAL COUNTRIES TO A THIRD MARKET

Exported from	To	All commodities	*L*-goods	*H*-goods
US, UK, E, J	*W*	.058	.022	.093
US, UK, E, J	*I*	.073	.002	.100
US, UK, E, J	*N*	.045	.025	.062
UK, E, J	USA	.247	.081	.366
US, E, J	UK	.205	.139	.280
US, UK, J	EEC	.377	.358	.427
US, UK, E	Japan	.354	.334	.265

Note: All results are not significant at the 95% probability level.

As shown in Table 5, the coefficients of concordance are calculated, first, for exports from the four industrial countries to aggregated markets, the world (W), industrial countries group (I) and non-industrial countries group (N). All the coefficients are not significant at the 95% probability level.[38] This means that the structure of comparative advantages in the four industrial countries is mutually dissimilar, as shown in Chart 3. Secondly, the coefficients of concordance in exports to one of the four industrial countries from the other three countries are also not significant showing the dissimilarity of export structures among industrial countries. These results of the concordance test are consistent with our Propositions.

Turning to the rank-correlation analysis, let us first examine the *competitive* or *complementary* relationship between exports of two countries to a third market through the comparison of the rank-correlation coefficient (Table 6). The relationship can be considered symmetrical and complementary if the coefficient of rank-correlation in export performance indices exported from two countries to a third maket is negative and significant at more than

[37] Chart 3 may be more interesting than the concordance and rank-correlation analysis since it shows not only the order, but also the height of export performance indices. The average, the standard deviation, and the coefficient of variance for curves shown in Chart 3 (as well as those for Sweden and Canada) have already been presented in Table 1.

[38] If Canada and Sweden are taken into account, the U.S., Canada, and Sweden have homogeneous characteristics of higher incomes and pro-capital-intensity relatively to the U.K., the EEC and Japan. It is interesting to find that the more homogeneous the group of countries we take as exporting countries regarding their exports of all commodities to the I-market, the larger the coefficient of concordance will be. When exporting countries include the six countries, the coefficient is .0739; if Japan, the most heterogeneous country, is excluded, it is .1097; if Japan and EEC are excluded, it increases to .3230* (which is significant at the 95% probability level); finally if the group includes the U.S., Canada, and Sweden, it increases further to .4763** (which is significant at the 95% probability level).

TABLE 6. COEFFICIENTS OF RANK-CORRELATION IN EXPORT-PERFORMANCE INDICES: EXPORTS FROM TWO COUNTRIES TO A THIRD MARKET

To / Exported from	*W*	*I*	*N*	US	UK	EEC	Japan
(1) All Commodities (74 items)							
US & E	−.655**	−.700**	−.499**	—	−.626**	—	−.177
US & J	−.547**	−.301*	−.515**	—	.052	.100	—
UK & E	−.309**	−.317**	−.332**	−.004	—	—	−.179
UK & J	−.273*	−.185	−.262**	−.166	—	−.227	—
US & UK	.058	.053	−.041	—	—	.322**	−.093
E & J	.189	.030	.010	−.218	−.004	—	—
(2) *L*-goods (35 items)							
US & E	−.508**	−.602**	−.245	—	−.808**	—	−.176
US & J	−.523**	−.220	−.515**	—	.085	.124	—
UK & E	−.265	−.287	−.311	−.064	—	—	.212
UK & J	−.390*	−.231	−.170	−.296	—	−.295	—
US & UK	−.115	−.183	−.307	—	—	.283	−.031
E & J	−.025	−.283	−.249	−.775**	−.153	—	—
(3) *H*-goods (39 items)							
US & E	−.723**	−.729**	−.699**	—	−.382*	—	−.226
US & J	−.455**	−.313	−.430**	—	.149	.261	—
UK & E	−.354*	−.319*	−.355*	.069	—	—	.105
UK & J	−.185	−.195	−.422**	.012	—	−.131	—
US & UK	.156	.201	.115	—	—	.290	−.185
E & J	.300	.156	.288	.065	−.009	—	—

Note: * Significant at the 95% probability level.
** Significant at the 99% probability level.

a 95 percent probability level while it is interpreted as similar and competitive if the coefficient is positive, insignificant or significant.[39]

(i) As regards exports of all commodities to an aggregate market, i.e., the world (*W*), industrial countries group (*I*) and non-industrial countries group (*N*), two-country pairs of the U.S. and EEC, the U.S. and Japan, the U.K. and EEC, and the U.K. and Japan show complementarity except in the exports from the U.K. and Japan to the *I*-market. Since one country of the above pair belongs to the higher incomes group while the other to the lower incomes group, the complementarity supports well Proposition 5.

(ii) The coefficient is larger in the relationship between the U.S. and EEC and between the U.S. and Japan while it becomes smaller in the relationship between the U.K. and the

[39] If the coefficient is significant but positive, the relationship is clearly similar and competitive. In such a case that the coefficient is not significant, either positive or negative, we cannot say anything definitely about the relationship. It is interpreted here, however, that for a more or less similar relationship (or not definitely symmetric), the coefficient appears to be insignificant. In other words, we adopt the criterion of dichotomy, whether symmetric or not.

EEC and between the U.K. and Japan because the gap in incomes level is larger in the former relationship and smaller in the latter relationship.

(iii) Exports from the two-country pairs of the U.S. and the U.K. (both of which belong to the higher incomes group) and of the EEC and Japan (both of which belong to the lower incomes group) show a competitive relationship which supports Proposition 6. If the whole range of shift in coefficients is taken into account, the case mentioned above as exceptional may not be so.

As regards exports to an aggregate market, phenomena almost similar to the above are seen in *H*-goods, whereas complementary relationships in *L*-goods are shown only in five cases: exports from the U.S. and EEC to *W* and to *I*, exports from the U.S. and Japan to *W* and to *N*, and exports from the U.K. and Japan to *W*. Almost all the relationships in exports of *L*-goods from the two industrial countries are competitive. This comes from the fact that *L*-goods have a longer history of development as compared with *H*-goods and the production and exports of *L*-goods have spread well over these countries.

As regards trade among the four industrial countries, almost all the relationships appear to be competitive in all commodities, as well as in *L*- and *H*-goods. This may be reasonable because, in the case of exports to such a disaggregate, specific market as each of the four industrial countries, the structure of exports is determined dominantly by the demand structure of the importing country. Other industrial countries are exporting competitively with each other so as to meet best the import-demand structure.[40] Thus, our Propositions are not well confirmed in these cases. However, we see a clear complementary relationship in the exports from the U.S. and the EEC to the U.K. whose income level is between that of the U.S. and the EEC. The large negative coefficient which also appeared in the exports of *L*-goods from the EEC and Japan to the U.S. may be an exceptional case. This may be because the EEC and Japan have, vis-à-vis each other, strong comparative advantages in different type of *L*-goods, perhaps in less labour-intensive goods in the EEC and in more labour-intensive goods in Japan, or in woolen manufactures in the EEC and in cotton manufactures in Japan.

In short, as far as exports from the two countries to an aggregate market are concerned, Propositions 5 and 6 are well supported. In the exports from two countries to a specific country market, these Propositions are to be obscured due to the strong influence of the demand structure in the importing country which is not taken into consideration in our theoretical model.

Let us now examine Propositions 3 and 4. Coefficients of rank-correlation between exports to two markets from a specific country are calculated as shown in Table 7. If the coefficient is significant at more than a 95 per cent probability level and positive, the export structures to the two markets are similar and *non-dualistic* while other cases with insignificant (either positive or negative) or with significant but negative coefficients show dissimilar and *dualistic* export structures.

First, in the comparison of exports of all commodities to the two aggregate markets, *I* and *N*, all of the four industrial countries, show without exception, non-dualistic export

[40] This factor makes our results more ambiguous in the case of bilateral exports which will be examined presently.

TABLE 7. COEFFICIENTS OF RANK-CORRELATION IN EXPORT-PERFORMANCE INDICES: EXPORTS FROM A COUNTRY TO TWO MARKETS

Exported from \ To	*I* & *N*	US & UK	UK & E	E & J	UK & J	US & E	US & J
(1) All Commodities							
USA	.786**	—	.826**	.614**	.504**	—	—
UK	.706**	—	—	.160	—	.254*	.125
EEC	.462**	.292*	.598**	−.055	.128	.238*	.247*
Japan	.435**	.535**	.626**	—	—	.667**	—
(2) *L*-goods							
USA	.870**	—	.860**	.628**	.490**	—	—
UK	.548**	—	—	.223	—	.281	.151
EEC	.397*	.163	.835**	.181	.071	.190	.034
Japan	.317	.536**	.604**	—	—	.682**	—
(3) *H*-goods							
USA	.679**	—	.815**	.541**	.468**	—	—
UK	.835**	—	—	.082	—	.349*	.140
EEC	.515**	.311	.343*	−.192	.262	.256	.447**
Japan	.422**	.541**	.592**	—	—	.564**	—

Note: * Significant at the 95% probability level.
** Significant at the 99% probability level.

structures.[41] This is reasonable since the structure of comparative advantages in the exporting country has strong influence upon, and is well reflected in, the exports to such aggregate markets like *I* and *N* in which exporting competition prevails from various countries. The coefficient becomes progressively smaller according to the following country order: U.S. (.786**), the U.K. (.706**), the EEC (.462**), and Japan (.435**). This means that if the income level of a country is the highest in the world (as in the case for the U.S.), all of the rest of the world is lower in income level; therefore, the non-dualistic character of exports to various markets is clearly expressed. The lower the income level, the more a country has to divide its exports to different markets of both higher and lower income levels; therefore, a less non-dualistic, or more dualistic, export structure will result. This is seen in the exports of *L*-goods from Japan to *I*- and *N*-markets. The coefficient is .317 and insignificant, meaning dualistic.[42] In the exports of *H*-goods, results are similar for all commodities except that

[41] This is also true for Sweden and Canada. The coefficients are:

	All commodities	*L*-goods	*H*-goods
Sweden	.804**	.719**	.826**
Canada	.680**	.694**	.658**

(** Significant at the 99% probability level.)

[42] Much attention has been paid in Japan to whether or not her export structure to advanced vs. less developed countries is dualistic and to the merits and/or shortcomings of the dualistic character. See, Saburo Okita, "Development of Japan's Exports," Nihon Seisansei Honbu, *World Economy and Japanese Trade*, Tokyo 1957, pp. 172-193. Hisao Kanamori, *Janan's Foreign Trade*, Tokyo 1965, pp. 89-116.

the order of coefficients is reversed between the U.S. and the U.K.

Second, in the exports from the industrial country to two other industrial country markets, there is regurality in coefficients of rank-correlation along the line of Propositions 3 and 4 as shown by the following.

(i) Japan's exports to the market-pairs of the U.S. and the U.K., the U.K. and EEC, and the U.S. and EEC show non-duality without exception for all commodities as well as *L*- and *H*-goods, respectively. This is reasonable since Japan has the lowest income level among the four industrial countries.

(ii) Similarly, American exports to a pair of countries show non-duality without exception since she has the highest income level.

(iii) The income level of the U.K. and the EEC is between the U.S. and Japan and very close to each other. This makes our observation somewhat ambiguous. If even a little higher income level in the U.K. is thought rigorously to bring about the divergence of comparative advantage structures, some of the results in Table 7 are not consistent to our Propositions (for example the .160 for the U.K.'s exports to the EEC and Japan, and the .254* for the U.K.'s exports to the U.S. and the EEC, as far as all commodities are concerned). These may not contradict our Propositions, however, if the closeness in income level between the U.K. and EEC is taken into consideration. The only exception may be the non-duality which appeared in the EEC's exports of all commodities (.247*) and *H*-goods (.447**) to the U.S. and Japan.[43] In short, it can be said that the performance of exports from a country to two markets, either aggregate or specific, supports well the validity of Propositions 3 and 4.

As a means of supplementing the previous observation, coefficients of concordance in export performance indices for exports from one of the four industrial countries to the rest are calculated as shown in Table 8. As is anticipated from the results of Table 7, all the coefficients of concordance are significant and positive, showing non-duality; furthermore there exists a descending order of value corresponding to the country-income ranking. The only exception is the exports of *L*-goods from the EEC to the U.S., the U.K., and Japan (the coefficient being .393). This may be due to the inclusion of Japan which is a somewhat heterogeneous market[44] and quite competitive with the EEC in exporting *L*-goods. If we recalculate the coefficient of concordance for the EEC's exports of *L*-goods to the U.S., the

[43] This may be due to the distorted and restrained pattern in Japan's imports of heavy manufactures and chemicals, resulting from her protectionistic policies.

[44] The heterogeneity of Japan's import structure as compared with other industrial countries may be indirectly shown by the fact that the coefficient of rank-correlation of a country's exports to the world and a certain industrial country is significantly high whereas it is insignificantly low for the U. K and the EEC when their exports are destined to Japan. As regards all commodities, for example, the coefficients are as follows:

Exported from \ to	*W* and USA	*W* and UK	*W* and EEC	*W* and Japan
USA	—	.624**	.805**	.523**
UK	.421**	—	.693**	.096
EEC	.447**	.329*	—	.125
Japan	.536**	.318*	.521**	—

* Significant at the 95% probability level.
** Significant at the 99% probability level.

TABLE 8. COEFFICIENTS OF CONCORDANCE IN EXPORT-PERFORMANCE INDICES: EXPORTS FROM A COUNTRY TO THREE MARKETS

Exported from	To	All commodities	*L*-goods	*H*-goods
USA	UK, E, J	.765**	.773**	.652**
UK	US, E, J	.453*	.479*	.460*
EEC	US, UK, J	.482**	.393	.560**
Japan	US, UK, E	.739**	.738**	.710**

Note: * Significant at the 95% probability level.
** Significant at the 99% probability level.

U.K., and either Canada or Sweden (instead of Japan), it becomes .639** or .729**, respectively (which is significant at the 99% probability level).

We have found the contrast that, while the concordance in exports from a certain country to various markets shows a clear similarity (or non-duality) in the reference country's export structure (Table 8), the concordance in exports from various countries to a specific market is not significant, showing the dissimilarity of export structures in various countries (Table 5). The contrast does not imply a contradiction between the two cases, but is only a different expression, depending on the reference country, of the different structures of comparative advantages in various countries.

Finally, coefficients of rank-correlation in export-performance indices is calculated, as shown in Table 9, as regards bilateral exports, i.e., the relationship between the exports from

TABLE 9. COEFFICIENTS OF RANK-CORRELATION IN EXPORT-PERFORMANCE INDICES: BILATERAL EXPORTS

	USA	UK	EEC	Japan	Canada
(1) All Commodities					
USA		.140	−.010	.017	.478**
UK			−.277*	.093	
EEC				.373**	
Japan					
(2) *L*-goods					
USA		−.140	.053	.033	.557**
UK			−.362*	.112	
EEC				.485**	
Japan					
(3) *H*-goods					
USA		.273†	−.012	.191	.296†
UK			−.027	.101	
EEC				.294†	
Japan					

Note: † Significant at the 90% probability level.
* Significant at the 95% probability level.
** Significant at the 99% probability level.

one industrial country to another and *vice-versa*. In addition to the four industrial countries under main consideration, Canada is mentioned in the table for our interests.

As Proposition 7 suggests, it is expected that bilateral exports between more heterogeneous countries will be dissimilar and of a *vertical-trade type*, resulting in a significant and negative coefficient. The significant and negative coefficient is found only in bilateral exports between the U.K. and the EEC for *L*-goods and all-commodities (the coefficient being $-.362^*$ and $-.277^*$, respectively, which are significant at the 95% probability level). However, a more significant and negative coefficient should appear in bilateral exports between more heterogeneous countries such as between the U.S. and Japan or between the U.K. and Japan, but it does not.

According to Proposition 8, the bilateral exports between more homogeneous countries should be similar to each other and of a *horizontal-trade type*. According to our criterion of dichotomy, this case should result in insignificant (either positive or negative), or significant but positive coefficients. The significant but positive coefficients are seen in the bilateral exports of *L*-goods and all commodities between the EEC and Japan (.485** and .373**, respectively) and between the U.S. and Canada (.557** and .478**, respectively) by the significance criterion at more than a 95% probability level. If the criterion is lowered to the 90% probability level, appropriate cases increase for *H*-goods, even between the U.S. and the U.K. If Canada is excluded from our consideration, insignificant coefficients, either positive or negative, account for two-thirds of the total cases in Table 9.

In short, almost all cases of bilateral exports appear to be of a horizontal-trade type with the one exceptional case being the vertical-trade-type between the U.K. and the EEC, which is questionable from the point of view of theory.

The evidence may be evaluated in such way to conclude that the rank-correlation test of bilateral exports fails to support Propositions 7 and 8. It is most difficult to verify the difference in comparative advantage structures in bilateral trade. Even those empirical studies done by MacDougall and others[45] evade dealing with the bilateral trade relationship. The failure is due to not the empirical study but to the theoretical model itself.

The model is constructed solely from the comparative advantage structures of various exporting countries in a multi-country setting and completely ignores the import-demand structures of those countries which would affect the results of our investigation. In the model the import-demand structure might be thought to be the reverse of the comparative advantage structure, but it is not true in the actual situation of world trade. The import-demand structure is certainly influenced by the structure of comparative *disadvantage* which is, however, neither taken into consideration in the model nor estimated in the empirical study. Moreover, the import-demand structure is affected strongly by trade policies through tariffs and quantitative restrictions and by transportation costs. Bilateral exports are determined not only by the comparative advantage structure of both sides, but more strongly by the import-demand structure. One country's exports should be examined in relation to the other's import-demand

[45] See, G. D. A. MacDougall, "British and American Exports: Study suggested by the Theory of Comparative Costs," *Economic Journal*, December 1951 and September 1952. R. Stern, "British and American Productivity and Comparative Costs in International Trade," *Oxford Economic Papers*, October 1962. G. D. A. MacDougall, M. Dowley, P. Fox and S. Pugh, "British and American Productivity, Prices and Exports: An Addendum," *Oxford Economic Papers*, October 1962. B. Balassa, "An Empirical Demonstration of Classical Comparative Cost Theory", *Review of Economics and Statistics*, August 1963.

structure. The case of bilateral exports might be also influenced by the consideration for keeping trade in manufacturing goods in balance.

Thus, the dominant influence of the import-demand structure in determining bilateral trade makes any comparison of bilateral export comparative advantage structures difficult and obscure. The difference in comparative advantage structures of various countries is revealed well only when the influence of import-demand structure is indifferent for the comparative advantage structures of the various exporting countries to be compared. This is so in the case where the comparison is undertaken for a country's exports to various markets, the import-demand structure of which is common to all other exporting countries, and in the case where the comparison is undertaken for various countries' exports to an aggregate market.

From the theoretical point of view, even the significant and positive coefficients in bilateral exports obtained in Table 9 are highly questionable. If two countries have homogeneous economies and a similar comparative advantage structure, bilateral exports between them would not take place or be very limited. Those significant and positive coefficients might be obtained merely by chance, or due to other factors such as horizontal trade within the same commodity category arising from product differentiation[46] and/or border-line trade.

VI. *Concluding Remarks*

We have constructed a theoretical model of the factor-propositions theorem and set up eight propositions to be empirically verified through the export-performance indices of six industrial countries (Section III). Propositions 1 and 2 have been satisfactorily verified using labour-intensive and capital-intensive commodity groups (Section IV). Through the analysis of rank-correlation between series of export-performance indices, it has been shown in Section V that exports from various countries to an aggregate market clearly reveal the difference in comparative advantage structures thus substantiating Propositions 5 and 6. Further, it was shown that exports from a specific country to various markets reveal similar tendencies and thereby support Propositions 3 and 4. An examination of bilateral exports along the line of Propositions 7 and 8 has been unsatisfactory, but this failure is due to the shortcoming of the model itself which ignores the import-demand structures of various countries in a multi-country setting. We may then conclude that, on the whole, the factor-proportions theorem has been substantially supported by our empirical tests.

If it is true that the factor-proportions theorem is valid and can be considered a strong guide for determining the pattern of exports of manufacturing goods from various countries of the world with different income levels, what are the practical implications this might present

[46] The possibility of horizontal trade within the same commodity category has been examined by various writers. See, P. J. Verdoorn, "The Intra-Bloc Trade of Benelux," E. A. G. Robinson, ed., *Economic Consequences of the Size of the Nations*, McMillan, London, 1963. Bela Balassa, "Tariff Reductions and Trade in Manufactures among the Industrial Countries," *American Economic Review*, June 1966. Hubert G. Grubel, "Intra-Industry Specialization and the Pattern of Trade," *Canadian Journal of Economics and Political Sciences*, August 1967. Kiyoshi Kojima, "The Pattern of International Trade among Advanced Countries," *Hitotsubashi Journal of Economics*, June 1964. N. P. G. Elkan, "How to Beat Backwash: The Case for Customs-Drawback Unions," *Economic Journal*, March 1965. Kiyoshi Kojima, "Towards a Theory of Agreed Specialization: Economics of Integration," *Festschrift Volume for Sir Roy Harrod* (forthcoming).

for trade policies.

After proving the validity of the strong-factor-intensity hypothesis underlying the factor proportions theorem, Hal B. Lary suggests that "The analysis of past trends and other features of the trade leads, I believe, to more hopeful conclusions than most other studies regarding the potentialities of exports of manufactures by less developed to developed countries...It will be evident, I trust, that the basic conditions for the successful growth of the trade include a receptive and cooporative attitude on the part of the importing countries and "outward-looking" policies on the part of the less developed countries—that is, a readiness on both sides to share in the international division of labor among countries at varying levels of economic development."[47]

In reality, the varidity of the factor-proportions theorem demands the liberalization of trade in manufactured goods throughout the world in order to maximize world productivity and welfare to allow a division of labour in manufacturing activities for nations of varying stages of development and income levels. To this end advanced countries should rapidly cease protecting their old and declining labour intensive industries, despite the fact that such structural adjustments may encounter difficulties, and leave the task of developing these industries to the developing nations. To promote the transformation of division of labour[48] in the world, the growth of promising manufacturing industries suitable for the less developed countries' factor-proportions should be assisted by means of aid in capital and technology and by the extension of tariff preferences.

Industrialization has, and will continue more rapidly to, spread throughout the world. Major parts of world trade in manufactures would follow the guide line of the factor-proportions theorem or the so-called "low-wage trade." How could, then, the advanced countries continue to expand their exports of manufactured goods? This would depend upon the creation of new commodities as the R & D theory stresses, the expansion of horizontal trade in more sophisticated manufactures among advanced countries, and the increase in exports of investment goods in exchange for labour-intensive goods from less developed countries.

[47] Hal B. Lary, *Imports of Manufactures from Less Developed Countries*, National Bureau of Economic Research, New York, 1968, Preface, p. xv.

[48] Harry G. Johnson, *Economic Policies Toward Less Developed Countries*, Brookings Institution, Washington, D. C., 1967, pp. 201-204.