AN EMPIRICAL ANALYSIS OF COMPARATIVE ADVANTAGE IN POSTWAR JAPAN USING TWO ALTERNATIVE METHODS

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When looking at Japan's position in international trade, we notice that some of the commodities which used to be exported extensively by Japan are facing severe competition from other countries – usually countries who were later starters of industrialization than Japan – or have even completely lost their competitive edge on the international market. The so-called light industries producing textile and textile products are examples. On the other hand, there are commodities which used to be considered exports of more technologically advanced countries but which Japan is currently not only able to produce domestically but also to export overseas. It is clear that during the past two decades, Japan's leading export commodities have changed their shares. What was the cause of this change and what were the production factors that characterized these exports?

Or, in the terminology of international trade, how did the structure of comparative advantage in international trade change for the Japanese economy as it grew at a very rapid rate during the postwar period? The present study is an attempt to address this question empirically by incorporating some of the elements of the theories of international trade that have burgeoned and developed in the past two decades.

These theories have emerged principally as an explanation of the Leontief Paradox which revealed – through calculations using the input-output table – that US exports embodied relatively more labor and less capital than did an equivalent amount of US competitive imports, despite the fact that the US was commonly thought to be a relatively capital-abundant country. Generally, the theories can be divided into two groups, the neo-factor proportions account and the neo-technology account, both of which attempt to bridge the gap between theory and reality.

The neo-factor proportions method attempts to refine the traditional two-factor Heckscher-Ohlin model of aggregate capital and labor by either admitting other factors of production – such as natural resources or land – into the model, or by disaggregating capital and labor into finer categories such as physical and human capital, or skilled and unskilled labor.

The neo-technology account seeks the explanation of the Leontief Paradox in factors that were totally left out of the simplified Heckscher-Ohlin model, such as technology, the timing of innovations, and the "ongoing process of relative growth and decay of products and industries", i.e., factors of production that are not directly tangible. Here, we do not assume that technology is free and universally available, but instead that its transmission involves time and costs. The technological gap and the product cycle theories come under this category.

The present paper is part of a longer study attempting to identify the characteristics and change in comparative advantage of Japan's trade structure between 1960 and 1977, taking into account factors of both the neo-factor proportions and the neo-technology theories, and examining how the trade structure is related to factor endowments. In this paper I will focus on the use of two different types of techniques addressing trade structure, viz., the Leontief-type input-output table analysis method (hereafter called the L-method) and regression analysis (hereafter, the R-method). Past empirical studies on comparative advantage have traditionally used either of these two techniques but here my purpose is to use both of them so that we may compare what different results arise through the use of different techniques on the same set of data. We now turn to the explanation and comparison of the nature of the results that emerge from the use of these two methods of analysis.

We start from the L-method. This technique calculates how much of each production factor went into the production of a representative export (or import) bundle, where "representative" means that the export (or import) of each commodity is scaled down so that the total amount is one million yen while the compositional shares of the commodities remain unchanged. The calculation is done for both "direct and indirect requirements" and for "direct requirements only". The latter calculates the amount of each productive factor that was employed directly in the production of the export bundle as a final product but not those used in producing the raw materials that are intermediate inputs to the industry producing the final product but outputs of certain other industries. In contrast, the former calculates both the direct factor requirements as presently described plus the indirect factor inputs that were necessary to produce the intermediate inputs, the intermediate inputs of these inputs, and so on, going beyond the final round of production. The calculation of the direct and indirect requirement is done as follows:

$X = AX + F$ where
F: final demand vector
X: production vector
A: input coefficient matrix

The production level of each commodity must be such that it satisfies the amount required as an intermediate good in the production of both other commodities and itself and the amount required as final demand, i.e., to be consumed as it is and not to be used as an input. How much of each commodity is required as intermediate input by each of the commodity-producing industries is calculated through the use of the input coefficient matrix indicating the technical interrelationship of the sectors. Thus, if we want to know how much of each sector's commodity is needed in the production of a final goods vector F, the solution is

$$X = AX + F,$$
$$X - AX = (I - A)X = F$$
$$X = (I - A)^{-1} F$$

Replacing the final goods vector by our representative export (or import) bundle vector and premultiplying $(I - A)^{-1}$ F by the factor requirement vector of each productive factor would yield a scalar expressing the amount of that factor required in the production of the representative bundle. The method just described would be fine if the economy were closed and obtained all of its intermediate inputs domestically. However, for a country like Japan, the amount of these inputs, especially raw materials, that are purchased from abroad cannot be neglected. We now consider an open economy:

$X = AX + F - M$ where
M: import vector

When F and M are known, $(I - A)X = F - M$
and $X = (I - A)^{-1} (F - M)$.

But since imports are dependent on the level of domestic productive activities, they should somehow be made endogenous. If we make M endogenous by making it directly proportional to gross domestic demand, each industry's import coefficient will be

$$m_j = M_j / (\sum_i X_{ji} + F_j^d)$$

where F^d is domestic final demand.
Let $\overline{M}$ be a matrix which has m_i ($i = 1, \ldots, n$) along its principal diagonal and zeros elsewhere. Then, $X = AX + F^d + F^e - \overline{M}(AX + F^d)$ where F^e is export final demand. From the definition of $\overline{M}$, $\overline{M}(AX + F^d)$ will yield the vector M. $(I - (I - \overline{M})A)X = F^d + F^e - MF^d + (I - M)F^d + F^e$ by factoring out the X, or $X + (I - (I - \overline{M})A)^{-1} ((I - \overline{M})F^d + F^e)$. $(I - \overline{M})A$ represents input coefficients for domestic inputs so by using $(I - (I - \overline{M})A)^{-1}$ we can obtain the direct and indirect coefficients of domestic inputs plus the first-round (direct) requirements of imported inputs.

In the above case we made M endogenous by assuming it to be directly proportional to gross domestic demand. An alternative inverted matrix can be obtained in the following manner. We make a distinction between the domestically produced sector (d) and the imported sector (m).

$$X = A^d X + F^d$$
$$M = A^m X + F^m$$
$$A^d + A^m = A$$
$$F^d + F^m = F$$

From the equation for the domestically produced sector,

$$X = (I - A^d)^{-1} F^d$$

This equation is very close the former model; $(I - \overline{M})A$ is A times the self-sufficiency rate and is conceptually close to A^d. $(I - \overline{M})F^d + F^e$ is also conceptually close to the domestic portion of final demand. The difference lies in the fact that while for the former model the break-down between the domestic and imported sectors was a constant for each commodity even in the case of final demand, here the break-down is represented by the actual ratio.

Thus, we have obtained and will make use of three inverted matrices: $(I - A)^{-1}$, $(I - (I - M)A)^{-1}$, and $(I - A^d)^{-1}$. We will refer to these as Matrix I, Matrix II, and Matrix III, respectively.[11]

We next explain the R-method. This is a technique whereby one or more explanatory variables are hypothesized as the source of variation of a certain dependent variable in a linear equation and the coefficients of each of the explanatory variables are obtained through estimation. Also obtained are the multiple correlation coefficient (R) which indicates the degree of general "fit", i.e., how well the data fit the relationship postulated in the linear equation, and the t-values of each of the estimated coefficients indicating the level of statistical significance of the relevant variable as a source of variation of the dependent variable. In the present study, the equations to be estimated will be in log-linear form and a separate equation will be estimated for each year. The change in comparative advantage over time is revealed in the change of the estimated coefficients over the observation period.

We will now point out the difference in the nature of the results obtained through these two methods:

1. The results of the R-method indicate how *intensively* the exports of the relevant year used the factor in question and how this intensity has changed over time as the export levels of the commodities have changed, i.e., whether exports as a whole have become more or less intensive in that factor. Thus we find out not the exact amount of the factor that went into the production of exports but whether the more intensive the use of that factor in the production of that commodity the higher (or lower) the export level. Rather than calculating the exact amount of the productive factor *embodied* in the exports, the R-method examines what productive factor *characterizes* strong export performance.

When observing the R-results, one must also take into account the degree of "fit" since for some years the hypothesized equation may be reasonable while for others it may be poor. This difference in the multiple correlations is not apparent just from looking at the estimated coefficients. The L-method, on the other hand, does not have the problem of different degrees of "fit" since estimation is not involved. Rather, it involves the calculation of the amount of a factor input used directly (and indirectly) in producing a certain export bundle, and the final result is a single scalar indicating how much of a certain factor was required for the production of this representative bundle. We will see whether this amount has increased or decreased as the representative bundle has changed over time.

2. It is easy to see that the regression results will be sensitive to what explanatory variables are included in the equation; the relationship among these variables, the exclusion of a necessary variable, etc., play a crucial role here. This will be seen in the different estimation results of the various versions of the equations postulated. This is not the case for the L-method as a separate scalar will be calculated individually for each input.

3. The original results of the Leontief analysis depend on the behavior of both exports and imports (and the same will be true for our L-analy-

sis) whereas the R-method conducts analyses for exports and imports separately. The R-method can be conducted using net exports as the dependent variable but the results are not included in this paper since they show poor fit for the particular set of data I used.

4. The classification for the L-method and R-method are not directly compatible; however, here we have conducted an L-method analysis with only those categories included in the R-analysis, i.e., the manufacturing industries alone, which will assure a certain degree of compatibility. It is noted that the L-method here uses a finer sectoral classification compared to past studies (59 sectors with the 1965 I-O table and 61 sectors with the 1975 I-O table).

5. The L-method deals with a certain export bundle, i.e., each commodity is scaled down so that the total of all exports is one million yen while the compositional share is the same as that of actual exports. The R-analysis uses absolute levels of exports and imports. This would not entail serious problems since a scaling down would divide all observations of the dependent variable by a constant which would result in a different constant term but unchanged coefficient estimates in a log-linear equation.

Next, we briefly explain the productive factors considered in this analysis. First of all, value-added is separated into wage value-added (wage bill) and non-wage value-added which represent human capital and physical capital, respectively. These are both *flow* terms. The percentage of personnel engaged in R&D activities and the percentage of R&D expenditures are proxies of the neo-technological variables, included in the analysis to examine the importance of technological factors in shaping today's trade structure. Labor differentiated by skill categories is included as a variable so we can see whether human skills, or alternatively technology embodied in laborers, are significant as explanatory variables. This differentiation, together with the separation of value-added into human and physical capital, is in line with the neo-factor proportions theory. Other production factors used in the analysis are the *stock* of physical capital, number of laborers, and manhours.(2)

In the L-method, export and import data (for the following categories: all commodities; manufactured commodities only; primary commodities only) are obtained for 1960, 1965, 1970, 1975 and 1977 while both the 1965 and 1975 I-O tables will be used. The R-method will employ trade data for "manufactured commodities only" for 1960, 1965, 1970, 1974, 1975, 1976, and 1977 while the factor requirements will be of 1965 and 1975. The use of technologies of these two years which are ten years apart is in order to see whether the results are sensitive to the use of the technology of a particular year.

We now turn to an analysis of the results. It can be seen from the above explanation that the computational output is quite voluminous. The numerical results presented here speak for themselves to a large extent so here I will point out the salient points with emphasis on comparison between the results of the two methods, concentrating on the analysis of the manufactured commodities case.

Looking at the results of the L-method using the 1965 I-O table, we note that over the observation period, Japan's ratio of export-import factor requirement (amount of that factor embodied in a "representative bundle" of exports/amount of that factor embodied in a "representative bundle" of imports) has increased for human capital, R&D expenditures, and possibly R&D personnel, professional and technical workers, and stock of physical capital. On the other hand, it is decreasing for labor and it does not show marked variation for the flow of physical capital. Comparing these observations to the results obtained using the 1975 I-O table, we see agreement for the variables for R&D expenditures, labor, and flow of physical capital. Human capital and R&D personnel now show a decrease over the observation period, and the variables for professional and technical workers and stock of physical capital show little variation, slightly increasing if anything. Thus, the same set of trade data can at times yield conflicting results when evaluated under different technologies. However, the use of the three different types of inverted matrices did not produce much disagreement in the results.(3)

We turn to the comparison of these results with those of the R-method. In contrast to the L-method, here the results are not very sensitive to technologies of different years, and the presence of other variables, while affecting the values of the estimated coefficients and the t-values, do not change trends. We make the following overall observations for exports using the R-method. (Import structures are affected by the structure of protection and since meaningful results were not obtained from the empirical analysis on imports, I will not elaborate on the observations.) The intensities of human capital and professional and technical workers are increasing while labor intensity is decreasing. Intensity of flow of physical capital is either increasing or oscillating, and definite conclusions cannot be drawn. The R&D variables and stock of physical capital also do not show clear trends.

The main agreements and disagreements that emerge as the result of using the two techniques may summarily be stated as follows:

1. The trends of the human capital variable and professional and technical workers variable show increasing trends in all cases except the L-method with 1975 technology, where they show uncertain and possibly decreasing trends.

2. The behavior of the flow of physical capital is not clear under any case. If anything, it seems stationary for the L-method, and oscillatory and in some periods increasing for the R-method. It may be noted that under the L-method including all traded commodities, this variable increases its ratio of export-import factor requirement.

3. R&D personnel is stationary or decreasing for the L-method while increasing for the R-method. The R&D expenditures variable does not indicate a clear trend under the R-method, but it shows a definitely increasing trend in the L-method under the technologies of both years.

4. The stock of physical capital shows uncertain movements under the R-method, while its behavior under the L-method is mostly even under the 1975 technology and increasing under the 1965 technology.

5. Labor is the sole variable for which we see total agreement. It shows a decreasing trend for exports and increasing trend for imports in all the cases of the two methods.

If we normalize the ratio of export-import factor requirements of various factors on the ratio of labor, we notice immediately that all the production factors considered in the L-method have increased their intensity relative to labor over time (the numerical values are not shown). With normalization on labor, we see agreement of results for the flow of human capital, R&D personnel, and professional and technical workers variables as well. Thus, through the L-method, we can definitely say that the representative export bundle is characterized by an increased intensity of all productive factors considered in this analysis relative to labor.

In comparing the results of the two methods, we saw agreements in some cases and inconclusiveness in others. It should be noted that there need not necessarily be total agreement between the results for the reasons stated before. This study has shown, in the process of attempting to examine some aspects of Japan's postwar trade structure, that one should note which of the two representative methods is employed when looking at the results of studies concerning comparative advantage since the results may be sensitive to the particular method used.

On the relevance of the neo-factor proportions and neo-technology theories, a few words must be said. Through the use of the two analytical methods it was observed that the comparative advantage of labor-intensive goods is declining and that of those goods intensive in R&D and human capital (or alternatively, professional and technical labor) is increasing. This is consistent with the neo-technology theory. The neo-factor proportions theory also proved relevant. We observed that the two forms of capital – physical and human – show different movements; thus it would not be appropriate to treat them as if they were perfect substitutes for each other. The same argument would carry over for labor divided into various skill categories. Under both methods of analysis, professional and technical workers variable definitely showed a different trend from that of (total and undifferentiated) labor.

Notes

(1) $(I-A)^{-1}$ is greater than the other two matrices; this should be

evident from the structure of these inverted matrices since $(I - A)^{-1}$ does not take import leakage into consideration while the others do. Concerning the two inverted matrices, one cannot be said to be unambiguously larger or smaller than the other. $(I - A^d)^{-1}$ uses domestically produced input coefficients A^d which represent the actual break-down ratio between the domestic and imported sectors for all demand sectors so it is suitable for the analysis of the year in question. However, concerning the stability of the domestically produced input coefficient, as to how much of a certain input is from domestic sources and how much from foreign sources is a rather flexible and not very stable matter. Thus, $(I - A^d)^{-1}$ is not necessarily suited for predictions on, say the repercussion effects of a particular industry. $(I - A)^{-1}$ is suitable for analyzing the structural interdependence of the industrial sectors, but does not take into consideration the endogenous movements of imports. Thus, as mentioned before, it would be unsuitable for the analysis of a country with a large import sector like Japan. $(I - (I - \bar{M})\, A)^{-1}$ is in between these two. Imports are represented through the import coefficient which is the ratio of imports to gross domestic demand. It does not have a separate import coefficient for each demand sector, which at the same time as being a drawback, has the merit of assuring stability.

(2) In the R-method, when we make use of the stock of physical capital, human capital should also be converted into stock terms through the use of a discount factor. However, the use of the flow of human capital would not affect the results if we use a single discount factor by which to divide the flow of human capital in all industries, since here again only the value of the constant term would be affected in a log-linear equation.

(3) When we compare the results obtained for manufactured commodities only to the other two types of categories, we note some interesting differences. For example, when all commodities are considered, the ratios for the flow of physical capital, R&D personnel, and professional and technical workers show increasing trends while for primary commodities the labor and R&D personnel contents are increasing and the professional and technical labor content is declining.

LEGEND

HK: flow of human capital (wage value-added)

PK: flow of physical capital (non-wage value-added)

RDR: personnel engaged in R&D activities
RDE: R&D expenditures
SPK: stock of physical capital
L: number of workers
MH: manhours
SK1: professional and technical workers
SK2: managers and officials
R: multiple correlation

Results of L-method (Manufactured Commodities Only) 1975 Technology

$$\text{RATIO} = \frac{\text{amount of that factor embodied in exports ("representative bundle")}}{\text{amount of that factor embodied in imports ("representative bundle")}}$$

Matrix & Factor / Year		1960	1965	1970	1975	1977
MAT I.	HK	1.2426	1.1290	1.0669	0.9941	1.0136
	PK	1.0021	0.9666	0.9478	0.9481	0.9448
	RDR	1.3928	1.2448	1.2264	1.0528	1.1168
	RDE	1.0024	1.1712	1.3018	1.2753	1.3274
	SPK	0.9056	0.9525	0.9500	0.9639	0.9386
	L	1.5377	1.2595	1.1050	0.9446	0.9705
	MH	1.2899	1.1832	1.1167	1.0234	1.0517
	SK1	0.8873	0.8886	0.9151	0.9115	0.9051
	SK2	1.4976	1.1972	1.0432	0.8946	0.9025
MAT II.	HK	1.3736	1.2375	1.1644	1.0574	1.0966
	PK	1.0784	1.0631	1.0528	1.0389	1.0574
	RDR	1.4722	1.3085	1.2882	1.0883	1.1650
	RDE	1.0386	1.2174	1.3562	1.3159	1.3793
	SPK	0.9517	1.0149	1.0197	1.0233	1.0078
	L	1.6672	1.3595	1.1884	0.9950	1.0351
	MH	1.4444	1.2925	1.2036	1.0689	1.1143
	SK1	0.9934	0.9914	1.0254	0.9882	1.0056
	SK2	1.6595	1.3138	1.1315	0.9421	0.9657
MAT III.	HK	1.4416	1.2846	1.2004	1.0743	1.1218
	PK	1.1349	1.1107	1.0945	1.0652	1.0942
	RDR	1.5125	1.3330	1.3069	1.0944	1.1755
	RDE	1.0511	1.2312	1.3716	1.3257	1.3928
	SPK	0.9812	1.0416	1.0441	1.0381	1.0275
	L	1.7459	1.4051	1.2166	1.0031	1.0492
	MH	1.5064	1.3338	1.2346	1.0825	1.1344
	SK1	1.0595	1.0433	1.0732	1.0139	1.0429
	SK2	1.7443	1.3648	1.1631	0.9520	0.9824
Direct requirement only	HK	1.9227	1.5516	1.3734	1.1169	1.1979
	PK	1.2128	1.2173	1.2224	1.1818	1.2444
	RDR	1.6644	1.3968	1.3425	1.0532	1.1375
	RDE	1.0410	1.1995	1.3480	1.2588	1.3251
	SPK	0.8590	0.9047	0.9161	0.9415	0.9052
	L	2.4469	1.7391	1.3728	0.9977	1.0597
	MH	2.1380	1.6315	1.3670	1.0560	1.1306
	SK1	1.2066	1.1781	1.2202	1.0472	1.1184
	SK2	2.8589	1.7906	1.2717	0.8611	0.8962

All Commodities

Matrix & Factor \ Year		1960	1965	1970	1975	1977
MAT I.	HK	0.9967	0.9486	0.9735	0.9092	0.9403
	PK	0.6638	0.6508	0.7143	0.6988	0.7046
	RDR	1.1944	1.2098	1.3290	1.1920	1.3381
	RDE	1.5157	1.8640	1.9739	1.9713	2.1572
	SPK	0.8983	0.9136	0.9664	0.9210	0.9199
	L	0.9018	0.8308	0.9017	0.7756	0.8341
	MH	1.4474	1.3580	1.2744	1.1820	1.2285
	SK1	0.6362	0.6427	0.6862	0.7041	0.6929
	SK2	1.0353	0.9391	0.9707	0.8586	0.8789
MAT II.	HK	0.9881	0.9344	0.9632	0.8962	0.9302
	PK	0.6312	0.6246	0.6941	0.6809	0.6893
	RDR	1.1955	1.2139	1.3403	1.1989	1.3527
	RDE	1.5520	1.9119	2.0255	2.0214	2.2182
	SPK	0.8812	0.8964	0.9545	0.9085	0.9083
	L	0.8772	0.8114	0.8877	0.7611	0.8223
	MH	1.4917	1.3691	1.2796	1.1763	1.2263
	SK1	0.6041	0.6064	0.6555	0.6716	0.6639
	SK2	1.0259	0.9282	0.9636	0.8476	0.8706
MAT III.	HK	0.9954	0.9346	0.9639	0.8928	0.9281
	PK	0.6313	0.6204	0.6903	0.6749	0.6846
	RDR	1.2050	1.2186	1.3459	1.1995	1.3563
	RDE	1.5660	1.9289	2.0445	2.0370	2.2383
	SPK	0.8856	0.8959	0.9552	0.9057	0.9060
	L	0.8833	0.8116	0.8870	0.7569	0.8190
	MH	1.5130	1.3776	1.2873	1.1774	1.2287
	SK1	0.6016	0.5970	0.6465	0.6599	0.6537
	SK2	1.0345	0.9298	0.9648	0.8442	0.8686
Direct requirement only	HK	0.7783	0.7154	0.7233	0.6580	0.6801
	PK	0.3453	0.3530	0.3917	0.3772	0.3852
	RDR	1.0754	1.1101	1.2132	1.0598	1.2234
	RDE	1.5986	1.9638	2.0632	2.0967	2.2950
	SPK	0.6432	0.6359	0.7127	0.6611	0.6460
	L	0.6557	0.6114	0.6592	0.5353	0.5909
	MH	1.6158	1.3101	1.1496	0.9987	1.0316
	SK1	0.3167	0.3124	0.3405	0.3425	0.3356
	SK2	0.8374	0.7296	0.7260	0.6008	0.6057

Primary Commodities Only

Matrix & Factor \ Year		1960	1965	1970	1975	1977
MAT I.	HK	1.0503	1.1010	1.2379	1.0467	1.0962
	PK	0.9893	1.0408	1.3941	1.0389	1.0935
	RDR	1.0239	1.1060	1.4911	1.1545	1.2931
	RDE	1.0493	1.0445	1.1139	1.1236	1.1418
	SPK	1.0569	1.1143	1.2639	1.0486	1.1066
	L	0.9731	1.0709	1.5520	1.0609	1.2304
	MH	1.1620	1.1320	0.9826	1.1703	1.1548
	SK1	0.5372	0.5171	0.8039	0.4816	0.5138
	SK2	0.9135	0.9663	1.3259	1.0505	1.1482
MAT II.	HK	1.0209	1.0732	1.2058	1.0054	1.0583
	PK	0.9536	1.0063	1.3579	0.9884	1.0484
	RDR	0.9912	1.0752	1.4590	1.1125	1.2570
	RDE	1.0249	1.0197	1.0863	1.0972	1.1170
	SPK	1.0276	1.0868	1.2321	1.0060	1.0679
	L	0.9371	1.0363	1.5147	1.0100	1.1854
	MH	1.1460	1.1151	0.9605	1.1512	1.1359
	SK1	0.4855	0.4653	0.7603	0.4210	0.4599
	SK2	0.8771	0.9308	1.2926	1.0057	1.1102
MAT III.	HK	1.0196	1.0726	1.2006	1.0022	1.0546
	PK	0.9520	1.0050	1.3500	0.9853	1.0445
	RDR	0.9904	1.0751	1.4537	1.1119	1.2562
	RDE	1.0239	1.0185	1.0838	1.0969	1.1164
	SPK	1.0261	1.0861	1.2264	1.0020	1.0636
	L	0.9358	1.0357	1.5071	1.0079	1.1828
	MH	1.1477	1.1165	0.9598	1.1525	1.1369
	SK1	0.4784	0.4571	0.7489	0.4125	0.4512
	SK2	0.8744	0.9282	1.2859	1.0034	1.1072
Direct requirement only	HK	0.7779	0.8259	0.7754	0.5348	0.5321
	PK	0.7252	0.7740	0.9419	0.5582	0.6069
	RDR	0.7887	0.8766	1.1173	0.8163	0.9244
	RDE	0.8966	0.8650	0.8597	0.9488	0.9332
	SPK	0.8510	0.9365	0.9092	0.5528	0.5714
	L	0.6858	0.7787	1.0665	0.5818	0.6939
	MH	1.0361	0.9715	0.6644	0.8873	0.8353
	SK1	0.2368	0.2042	0.4164	0.1217	0.1651
	SK2	0.5918	0.6309	0.8616	0.6035	0.6588

Manufactured Commodities Only (1965 technology)

Matrix & Factor \ Year	1960	1965	1970	1975
MAT I. HK	1.0102	1.0603	1.0913	1.1575
PK	1.0293	0.9977	0.9944	0.9847
RDR	1.0652	1.0420	1.0803	1.1074
RDE	0.8960	1.0214	1.1093	1.2289
SPK	0.5409	0.5830	0.5989	0.5256
L	1.1832	1.1313	1.1010	1.1005
SK1	0.8867	0.9285	1.0304	1.1219
SK2	1.1556	1.1118	1.0835	1.0801
MAT II. HK	1.1442	1.1461	1.1656	1.2246
PK	1.0408	1.0265	1.0450	1.0518
RDR	1.1338	1.0796	1.1134	1.1352
RDE	0.9357	1.0520	1.1421	1.2668
SPK	0.8281	0.9090	0.9427	0.9781
L	1.3658	1.2356	1.1786	1.1581
SK1	1.0071	0.9929	1.0997	1.1940
SK2	1.3353	1.2135	1.1561	1.1296
Direct requirement only HK	1.3375	1.2087	1.1966	1.2217
PK	0.8904	0.9176	0.9903	0.9903
RDR	1.1296	1.0384	1.0695	1.0758
RDE	0.8674	0.9638	1.0622	1.1767
SPK	0.7189	0.7445	0.8018	0.8386
L	1.7460	1.3670	1.2228	1.1296
SK1	0.9900	0.9638	1.1210	1.2611
SK2	1.6582	1.3073	1.1538	1.0415

Results of Methods: Estimated Coefficients (number in parentheses are the t-values)

Equational form: $X = \alpha + \beta_1 HK + \beta_2 PK + \beta_3 L$, etc.
1975 technology

Dependent variable \ Independent variable	HK	PK	L		R
Exports in 1960	−1.7475 (−1.4060)	0.1004 (0.2275)	2.7292 (2.5757)		0.5983
1965	0.6443 (0.8774)	−0.2639 (−1.0122)	0.5843 (0.9334)		0.7099
1970	1.1148 (1.4712)	−0.1708 (−0.6349)	0.1322 (0.2047)		0.7358
1974	2.0096 (2.2618)	−0.08166 (−0.2589)	−0.9405 (−1.2416)		0.7044
1975	2.1887 (2.5513)	0.02427 (0.0797)	−1.2832 (−1.7545)		0.7202
1976	2.1793 (2.5127)	−0.06610 (−0.2147)	−1.0232 (−1.3839)		0.7237
1977	1.6991 (1.9995)	0.1155 (0.3827)	−0.7880 (−1.0877)		0.7247

Dependent variable \ Independent variable	PK	SK1	L	RDE	R
Exports in 1960	−0.8241 (−0.5152)	0.1214 (0.2744)	2.2032 (1.8275)	−0.4750 (−0.9190)	0.6062
1965	−0.3794 (−0.4094)	−0.2872 (−1.1201)	1.1675 (1.6712)	0.5266 (1.7583)	0.7280
1970	−0.08719 (−0.0919)	−0.1982 (−0.7552)	0.8169 (1.1424)	0.6182 (2.0168)	0.7566
1974	1.0654 (0.9391)	−0.1032 (−0.3288)	−0.4026 (−0.4709)	0.4857 (1.3251)	0.7152
1975	1.2040 (1.1021)	0.01832 (0.0061)	−0.7222 (−0.8771)	0.5065 (1.4350)	0.7320
1976	1.2690 (1.1455)	−0.08683 (−0.2834)	−0.5047 (−0.6045)	0.4682 (1.3081)	0.7334
1977	0.6321 (0.5862)	0.09115 (0.3056)	−0.1802 (−0.2217)	0.5488 (1.5754)	0.7385

Dependent variable \ Independent variable		HK	PK	L	RDR	R
Exports in	1960	−1.7833 (−1.4226)	0.08292 (0.1860)	2.5019 (2.1428)	0.2701 (0.4790)	0.6005
	1965	0.6101 (0.8265)	−0.2805 (−1.0687)	0.3672 (0.5340)	0.2580 (0.7770)	0.7136
	1970	1.0216 (1.3865)	−0.2162 (−0.8253)	−0.4594 (−0.6694)	0.7030 (2.1210)	0.7586
	1974	1.9037 (2.1982)	−0.1333 (−0.4330)	−1.6134 (−2.0002)	0.7997 (2.0528)	0.7290
	1975	2.0946 (2.4907)	−0.02165 (−0.0724)	−1.8811 (−2.4016)	0.7106 (1.8784)	0.7398
	1976	2.0767 (2.4550)	−0.1161 (−0.3860)	−1.6746 (−2.1255)	0.7741 (2.0343)	0.7460
	1977	1.6005 (1.9285)	0.06737 (0.2283)	−1.4144 (−1.8297)	0.7443 (1.9937)	0.7461

Dependent variable \ Independent variable		PK	SK1	L		R
Exports in	1960	−0.1182 (−0.2926)	−0.2978 (−0.7881)	1.5593 (3.0435)		0.5856
	1965	−0.2374 (−1.0159)	0.2978 (1.3624)	0.9056 (3.0550)		0.7163
	1970	−0.1322 (−0.5601)	0.5399 (2.4464)	0.6736 (2.2511)		0.7545
	1974	0.07738 (0.2736)	0.6630 (2.5064)	0.2172 (0.6057)		0.7110
	1975	−0.02987 (−0.7027)	0.8020 (3.6264)	0.2330 (0.9212)		0.6795
	1976	−0.03940 (−0.9337)	0.7255 (3.3054)	0.4059 (1.6172)		0.6976
	1977	0.2262 (0.8461)	0.6429 (2.5712)	0.1426 (0.4205)		0.7380

Dependent variable \ Independent variable	HK	SK1 + SK2	L	R
Exports in 1960	−0.2055 (−0.5252)	0.1777 (0.1502)	1.2052 (0.9391)	0.5797
1965	−0.1486 (−0.6512)	−0.3576 (−0.5182)	1.4416 (1.9252)	0.7069
1970	0.01988 (0.0834)	0.4077 (0.5660)	0.5773 (0.7386)	0.7257
1974	0.2665 (0.9290)	0.2117 (0.2441)	0.3912 (0.4156)	0.6720
1975	0.003167 (0.0703)	0.7167 (1.1232)	0.1893 (0.2799)	0.6088
1976	−0.008067 (−0.1823)	0.5459 (0.8708)	0.4710 (0.7089)	0.6417
1977	0.4116 (1.5127)	−0.02408 (−0.0293)	0.5434 (0.6088)	0.7014

Dependent variable \ Independent variable	SPK	HK	L	R
Exports in 1960	−0.3325 (−0.8079)	−1.6953 (−1.4125)	2.8497 (2.7852)	0.5321
1965	0.04959 (0.1948)	−0.4216 (−0.5679)	1.2182 (1.9248)	0.6268
1970	−0.05925 (−0.2301)	0.5486 (0.7305)	0.4682 (0.7314)	0.6788
1974	−0.1613 (−0.5425)	1.8885 (2.1777)	−0.7823 (−1.0581)	0.6521
1975	−0.02486 (−0.0858)	2.0027 (2.3711)	−1.0337 (−1.4355)	0.6643
1976	−0.2750 (−0.9590)	2.2077 (2.6404)	−0.9628 (−1.3507)	0.6855
1977	−0.1856 (−0.6492)	1.9198 (2.3028)	−0.7752 (−1.0907)	0.6729

戦後日本における比較優位の実証分析
——二つの方法を使用して——
〈要　　約〉

小　川　和　子

日本の代表的な輸出品目は時代とともに大きく変わって来たが，本小論文では日本の貿易に於る比較優位が1960年から1975年迄の期間にどのように変化したかを分析してみた。

1．実証分析に於ては，「レオンティエフ逆説」以来提唱され始めた「新要素比率説」及び「新技術説」的な要素の導入を試み，アメリカ貿易に於る比較優位をよりよく説明する為に考え出された理論が日本の場合にも妥当かどうかを調べてみた。

2．従来の比較優位の実証分析はレオンティエフ的な産業連関分析か，回帰分析のどちらかを分析手法として用いているが，本小論文では同じデータをこの二つの異なった手法で分析している。異なった手法を用いた場合，同じデータから果して同じ結論が導き出せるかを調べることが本小論文の目的の一つである。(異なった結果が出た場合には、比較優位の分析結果をみる場合はどちらの分析手法を用いるかによって結果が左右されるという事に留意する必要がある。)

3．実証分析の結果，説明変数によっては手法によって結果の一致を見ないものもあった。主な結論は以下の通りである。

① 全体として，人的資本及び専門職・技術関係の労働力を表わす変数は時とともに重要になる。

② 産業連関分析の下では，日本の貿易に於る研究開発関係の変数の重要性は増して来ており，この意味では新技術説は日本にもあては

まる。

③ 新要素比率説に従って資本を物的資本と人的資本に区別すると，この二種類の資本が異なった動きを示すことがわかる。この為，二つをまとめて単に「資本」として扱うことは危険である。

④ 日本の貿易の比較優位は，労働集約的なものから離れる傾向にあることが判明した。