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Japan's Economic Growth and Balance of Trade

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#54

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I. INTRODUCTION

In the literature on the relation between economic growth and balance of payments, the familiar two-country framework is often used for analytical purposes. The countries may be used to represent a particular country whose balance of payments is under consideration and the rest of the world. Within this framework, it might be expected that, other things being equal, if country A's income rises due to productivity increases, country A's demand for country B's exports would rise, and the balance of payments would turn against country A. Sir John Hicks [4], however, has pointed out that in practice, the opposite result is possible. Such a "weird case" may be attributable, according to Hicks, to the presence of biased rather than uniform growth.

It is the purpose of this paper to study the case of post-war Japan to shed some light on Hicks' argument. The Japanese case is interesting because, while it has been growing faster relative to the rest of the world, it has a tendency to experience trade surpluses.

Our paper is organized as follows: Section II presents our theoretical model, extending a familiar aggregate model to disaggregate levels. The method of estimating the parameters of our model is explained and the empirical results given in Section III. Section IV summarizes our findings with some concluding remarks.

II. THE MODEL

Models on the trade balance of a country are formulated generally in terms of income and relative price effects on imports and exports. Specifically,

2.1 $$T = \pi \frac{X}{M}$$

2.2 $$\pi = \frac{P}{P*}$$

2.3 $$M = f\left(\frac{1}{\pi}, Y\right)$$

2.4 $$X = g(\pi, Y^*)$$

where

T = export ratio

M = imports

X = exports

P = price level

Y = income

π = terms of trade between exports and imports

and the star (*) denoting the rest-of-the-world terms. According to Professor Harry Johnson's celebrated "basic equation" [6]:

2.5 $$R_T = [(1-\eta^*-\eta)\, r_\pi] + [\epsilon^* R^* - \epsilon R]$$

R = rate of growth of Y

R_T = rate of change of T

r_π = rate of change of the terms of trade π

ϵ = income elasticity of demand for imports

η = price elasticity of demand for imports

(* denoting rest-of-the-world items)

The two bracketed terms on the right-hand side of Equation 2.5 are the "price term" and the "income term" respectively.

Recalling the case cited in the previous section where $r_\pi = R^* = 0$, Equation 2.5 reduces to $R_T = -\epsilon R$, whereby one might expect the trade balance in the growing country to turn unfavorable.[1]

Continuing to make the simplifying assumption that there is no change in prices ($r_\pi = 0$), if both countries enjoy economic growth, Equation 2.5 becomes $R_T = \epsilon^* R^* - \epsilon R$. If $R > R^*$ (as in the case of Japan), for R_T to be positive would imply that $\epsilon < \epsilon^*$.[2]

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[1] In consisting of a basket of goods, M is unlikely to be an inferior "good," and ϵ is expected to be non-negative.

[2] It is reasonable to assume a priori that ϵ and ϵ^* are both positive.

So far, imports and exports have been treated in the aggregate. Let us re-write their functions in explicit form:

2.3a $$M = a\,(\frac{1}{\pi})^{\eta}\,Y^{\epsilon}\,e^{u}$$

2.4a $$X = b\,\pi^{\eta^*}\,y^{*\epsilon^*}\,e^{u^*}$$

u and u* being stochastic terms.

Now

2.6 $$\Sigma P_{m_i}\,M_i \doteq P^*M$$

2.7 $$\Sigma P_{x_j}\,X_j \doteq PX$$

where $P_{m_i}\,M_i$ and $P_{x_j}\,X_j$ are respectively the value of imports of the i^{th} good and the value of exports of the j^{th} good.

Assume

2.8 $$M_i = a_i\,\pi_i^{\eta_i}\,y^{\epsilon_i}\,e^{u_i}$$

and

2.9 $$X_j = b_j\,\pi_j^{*\eta_j^*}\,y^{*\epsilon_j^*}\,e^{u_j^*}$$

2.10 $$\pi_i \equiv P_{m_i}/P$$

2.11 $$\pi_j^* \equiv P_{x_j}/P^*$$

where P_{m_i} = import price of the i^{th} good

P_{x_j} = export price of the j^{th} good.

Then by Equations 2.6 and 2.7:[1]

1

$$\epsilon \equiv \frac{Y}{M}\frac{\partial M}{\partial Y} \doteq \frac{Y}{M}\frac{\partial\left(M_i \frac{P_{m_i}}{P^*}\right)}{\partial Y} = \frac{Y}{M}\Sigma \frac{P_{m_i}}{P^*}\epsilon_i \frac{M_i}{Y}$$

$$= \Sigma\, \epsilon_i \frac{P_{m_i} M_i}{P^* M}$$

$$\eta \equiv \frac{(\frac{1}{\pi})}{M}\frac{\partial M}{\partial(\frac{1}{\pi})} \doteq \frac{\frac{1}{\pi}}{M}\Sigma \frac{\partial\left(\frac{P_{m_i} M_i}{P^*}\right)}{\partial \pi_i}\frac{d\pi_i}{d(\frac{1}{\pi})}$$

Assuming $\frac{dP_{m_i}}{dP} = 0$ and $\frac{dP^*}{dP} = 0$,

$$\frac{\partial\left(\frac{P_{m_i} M_i}{P^*}\right)}{\partial \pi_i} = \frac{P_{m_i}}{P^*}\frac{\eta_i M_i}{\pi_i} \quad \text{and} \quad \frac{d\pi_i}{d(\frac{1}{\pi})} = \frac{d(\frac{P_{m_i}}{P})}{d(\frac{P^*}{P})} = \frac{P_{m_i}}{P^*}$$

$$\therefore \eta \equiv \frac{(\frac{1}{\pi})}{M}\frac{\partial M}{\partial(\frac{1}{\pi})} \doteq \frac{\frac{1}{\pi}}{M}\Sigma \frac{P_{m_i}}{P^*}\frac{\eta_i M_i}{\pi_i}\frac{P_{m_i}}{P^*} = \Sigma\, \eta_i \frac{P_{m_i} M_i}{P^* M}$$

Similarly, it can be shown that

$$\epsilon^* \doteq \Sigma\, \epsilon_j^* \frac{P_{x_j} X_j}{PX}, \quad \eta^* \doteq \Sigma \eta_j^* \frac{P_{x_j} X_j}{PX}$$

$$\epsilon \doteqdot \Sigma\epsilon_i \frac{P_{m_i} M_i}{P^* M}$$

$$\eta \doteqdot \Sigma\eta_i \frac{P_{m_i} M_i}{P^* M}$$

2.12

$$\epsilon^* \doteqdot \Sigma\epsilon_j \frac{P_{x_j} X_j}{PX}$$

$$\eta^* \doteqdot \Sigma\eta_j^* \frac{P_{x_j} X_j}{PX}$$

The model is further extended by considering that the income and price elasticities are not necessarily constant over time.[1] In Professor Johnson's formulation already referred to, the bigger the income elasticity of world demand for domestic exports (ϵ^*) is than the income elasticity of domestic demand for imports (ϵ), the more favorable is the domestic trade balance (other things being equal). In a

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[1]The allowance for disproportionate changes in P_{m_i} and in P_{x_j} as well as this additional consideration make our model different from that in S. Y. Kwack [7] which was applied to the case of the U.S.

dynamic context, the income-elasticity differential will increase if the income elasticity of world demand for domestic exports grows faster than that of domestic demand for imports.

However, theory does not suggest any particular form of the transformation function for incorporating this feature into our model. We therefore adopt the simplest (linear) form

2.13 $$\epsilon = \epsilon_o + \epsilon_1 t$$

2.14 $$\epsilon^* = \epsilon_o^* + \epsilon_1^* t$$

where t = time

To be even more general, we may also write

2.15 $$\eta = \eta_o + \eta_1 t$$

2.16 $$\eta^* = \eta_o^* + \eta_1^* t$$

Finally, the dynamic formulation of the income and price elasticities are also similarly extended to their disaggregate counterparts.

III. ESTIMATION AND EMPIRICAL FINDINGS

Our empirical analysis is organized according to (1) whether the aggregate or disaggregate approach was used, and (2) whether the elasticities are hypothesized to follow secular trends (static or dynamic formulations).

The Method of Ordinary Least Squares (OLS) was applied to multiple regression equations in the double-logarithmic form. The data we used consist of times-series figures on the following dependent variables:

M -- Japan's total import quantum index

M_i -- Japan's quantity of import index of the i^{th} good

X -- Japan's total export quantum index

X_j -- Japan's quantity of export index of the j^{th} good

and figures on the following independent variables:

P_m -- Price index of Japan's imports

P_{m_i} -- Price index of Japan's imports of the i^{th} good

P_w -- Japan's wholesale price index

P_x -- Price index of Japan's exports

P_{x_j} -- Price index of Japan's exports of the j^{th} good

P_x^* -- "Competitor's export price index"[1]

Y -- Index of Japan's real GNP

Y^* -- Real gross domestic product index of world

Figures for M, M_i, X, X_j, P_m, P_{m_i}, P_x, P_{x_j} are obtained from Bank of Japan, Economic Statistics Annual, and figures for P_w, P_x^*, Y and Y^* are taken from the UN Statistical Yearbook for the period 1953-1967, and are shown in our statistical appendix at the back of this paper. (See Tables A-1, A-2, and A-3). The former source categorizes imports (M_i) into 8 groups (Foodstuffs, Textile Materials, Chemical and Allied Products, Machinery and Equipment, Mineral Fuels, Metal Ores and Scrap, Other Crude Materials, and Miscellaneous), and exports (X_j) into 7 groups (Foodstuffs, Textiles, Chemicals and Allied Products, Machinery and Equipment, Metals and Metal Products, Non-metallic Mineral Products, and Miscellaneous). Since all the variables are given as indexes, we have uniformly converted the base year to 1965.

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[1]This is actually the unit value index of exports of manufactured goods. This index is a weighted average of 11 industrial countries. No adjustment has been made about the inclusion of Japan due to economy of research time.

A. Income Elasticities

(i) Aggregate approach

Equations 2.3a and 2.4a may be estimated in the double-logarithmic form

$$3.1 \qquad \log M = \log a + \epsilon \log Y + \eta \log (P_m/P_w) + u$$

$$3.2 \qquad \log X = \log b + \epsilon^* \log Y^* + \eta^* \log (P_x/P^*_x) + u^*$$

The results are shown in Table 1. Table 1 not only shows our estimates, but also those of Houthakker-Magee [5] compared with T. C. Chang's estimates of the pre-war period [3].[1]

Since the period covered by Houthakker-Magee (1951-1966) are approximately the same as ours (1953-1967), our results are expected to be similar to theirs. While the data we used are slightly different from theirs, and further data refinement is always desirable, the similarity in our results with theirs further justifies our reliance on the proxy measure of $P_x{}^*$.[2]

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[1] Another related study for the post-war period has been made by Baba-Tatemoto [1].

[2] See note 1 on page 10 above. This proxy variable is different from the corresponding one used by Houthakker-Magee.

Table 1

	ϵ	ϵ^*	η	η^*	R^2	D-W
T. C. Chang (1924-1938)	1.35	1.08	-0.47	-0.60	.84 .70	
Houthakker-Magee (1951-1966)	1.23 (13.06)	3.55 (14.82)	-0.72 (-2.40)	-0.80 (-1.78)	.985 .984	2.40 1.04
Ujiie-Yeung (1953-1967)	1.38 (18.71)	3.17 (8.80)	0.17 (0.41)	-0.72 (-0.89)	.98 .98	2.10 0.68

Note: The number in parenthesis below each coefficient is a t-ratio.

Table 1 shows that the post-war estimates of ϵ^* are approximately three times as high as their pre-war counterparts, while the level of ϵ has apparently remained at about the same level. This suggests that we should consider changes in the income elasticities over time.

In incorporating secular trends into our analysis, Equations 2.13 and 2.14 are substituted into Equations 2.3a and 2.4a, and the following regressions were run:

$$3.3 \quad \log M = \log a + \epsilon_o \log Y + \epsilon_1 t \log Y + \eta \log (P_m/P_w) + u$$

$$3.4 \quad \log X = \log b + \epsilon_o^* \log Y^* + \epsilon_1^* t \log Y^* + \eta^* \log (P_x/P_x^*)$$

The results are presented in Table 2 where it can be seen that both ϵ_1 and ϵ_1^* are not significant at the 5% level.[1]

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[1]Substituting Equations 2.13 and 2.14 together with Equations 2.15 and 2.16 into Equations 2.3a and 2.4a was als tried:

$$3.5 \quad \log M = \log a + \epsilon_o \log Y + \epsilon_1 t \log Y + \eta_o \log (P_m/P_w) + \eta_1 t \log (P_m/P_w) + u$$

$$3.6 \quad \log X = \log b + \epsilon_o^* \log Y^* + \epsilon_1^* t \log Y^* + \eta_o^* \log (P_x/P_x^*) + \eta_1^* t \log (P_x/P_x^*) + u^*$$

The results are poor due to the existence of multicollinearity between the first and the second independent variables as well as serious autocorrelation in the export function. It was therefore deemed unnecessary to reproduce these results in de

Table 2

	ϵ_o, ϵ_o^*	ϵ_1, ϵ_1^*	η, η^*	R^2	D-W
M	2.644 (4.174)	-0.023 (-2.012)	0.387 (1.016)	.98	2.0[illegible]
X	1.426 (0.542)	0.018 (0.667)	0.015 (0.011)	.98	0.72

However, we do not consider this evidence as conclusive because the real relationships may be hidden by the process of aggregation. We therefore turn to the disaggregate approach.

(ii) Disaggregate approach

First, the disaggregate static formulation of the income elasticities was estimated as follows:

$$3.7 \quad \log M_i = \log a_i + \epsilon_i \log Y + \eta_i \log (P_{m_i}/P_w) + u_i$$

$$3.8 \quad \log X_j = \log b_j + \epsilon_j^* \log Y^* + \eta_j^* \log (P_{x_j}/P_x^*) + u_j^*$$

The results are presented in Table 3, where it can be seen that all the ϵ_i's and the ϵ_j^*'s are significantly different from zero at the 5% level.

Table 3

	ε_i	η_i	R^2	D-W
M_1	1.20 (6.83)	0.99 (1.285)	.83	0.59
M_2	0.356 (3.043)	-0.753 (-2.181)	.86	2.21
M_3	1.73 (8.902)	0.334 (0.456)	.98	1.435
M_4	1.89 (3.926)	-1.641 (-1.86)	.81	0.811
M_5	2.045 (16.617)	0.0239 (0.089)	.99	1.807
M_6	1.608 (4.473)	-2.471 (-2.118)	.79	2.544
M_7	1.409 (52.676)	0.385 (2.204)	.99	2.384
M_8	2.002 (10.856)	1.699 (1.859)	.91	2.405
	ε_j^*	η_j^*	R^2	D-W
X_1	2.05 (10.155)	-2.161 (-4.635)	.89	1.887
X_2	1.2053 (3.777)	-2.172 (-2.52)	.92	1.299
X_3	4.147 (9.684)	-0.466 (-1.464)	.99	2.007
X_4	5.47 (13.693)	0.226 (0.423)	.98	0.896
X_5	2.999 (8.637)	-1.857 (-3.849)	.98	1.625
X_6	2.361 (20.578)	-3.317 (-5.64)	.97	1.839
X_7	3.287 (15.763)	-2.41 (-4.148)	.95	1.202

Next, Zellner's Seemingly Unrelated Regression Method (SUR) [13] was tried on the assumption that certain disturbance elements (such as dock strikes, changes in tariff structure, etc.) are contemporaneously common to the M_i's as a group and to the X_j's as a group. Regressions were run using the joint GLS method (see [11, pp. 298-302]). The results, however, were quite similar to those obtained from the separate regressions. This need not imply the absence of contemporaneous covariances in the disturbance terms, due to the fact that in the joint estimation of the M_i equations, Y was an important variable common to all of them, and the same thing was true of Y* in the case of the X_j equations, so that the matrix of independent variables is dominated by similar rather than different variables. For economy of space, we will not report our experimentation with the SUR method any further.

Before going further with analyzing the implications of the results of Equations 3.7 and 3.8, we investigated whether the dynamic formulations of the elasticities might be statistically more fruitful by means of Equations 3.9 and 3.10 and Equations 3.11 and 3.12:

3.9 $\log M_i = \log a_i + \epsilon_{o_i} \log Y + \epsilon_{1_i} \cdot t\log Y + \eta_i \log (P_{m_i}/P_w) + u_i$

3.10 $\log X_j = \log b_j + \epsilon^*_{o_j} \log Y^* + \epsilon^*_{1_j} t\log Y^* + \eta^*_j \log (P_{x_j}/P^*_x) + u_j$

$$3.11 \quad \log M_i = \log a_i + \epsilon_{o_i} \log Y + \epsilon_{1_i} . t \log Y + \eta_{o_i} \log (P_{m_i}/P_w) + \eta_{1_i} t \log (P_{m_i}/P_w) + u_i$$

$$3.12 \quad \log X_j = \log b_j + \epsilon^*_{o_j} \log Y^* + \epsilon^*_{1_j} t \log Y^* + \eta_{o_j} \log (P_{x_j}/P^*_x) + \eta^*_{1_j} t \log (P_{x_j}/P^*_x) + u^*_j$$

Serious multicollinearity resulted from the strong correlation between the first and the second independent variables in Equations 3.9 and 3.10 and again between these variables as well as between the third and fourth independent variables in Equations 3.11 and 3.12. The statistical results were therefore poor relative to those of Equations 3.7-3.8, so that we decided to discontinue the line of investigation involved in Equations 3.9-3.12 and revert back to analyzing more deeply the results of Equations 3.7-3.8. Moreover, the computed coefficients of the trend term in Equations 3.9-3.12 were found to be insignificantly different from zero. We therefore assume that there is no trend in each of the commodity group's income elasticity.

Now, assuming constancy of the income elasticity in each commodity group, we can compute the aggregate elasticities

using Equation 2.12. The shares of Japan's imports and exports are shown in Table A-3. These aggregate elasticities shown in Table 4 are found to change over time due to changes in the share of each commodity group in total imports and exports. Moreover, it can be seen that ϵ_t^* grows faster than ϵ_t. When we fit linear trend lines to these elasticities, we can see the difference in the rate of increase in ϵ_t and ϵ_t^* more clearly.

3.13 $\epsilon_t = \epsilon_{ot}$	+ $\epsilon_{1t}\, t$		+ u_t	R^2
1.22 (60.08)	0.025 (11.18)			0.90
3.14 $\epsilon_t^* = \epsilon_{ot}^*$	+ $\epsilon_{1t}^*\, t$		+ u_t^*	R^2
2.50 (60.59)	0.077 (17.04)			0.95

Equations 3.13 and 3.14 show that ϵ_t^* grows approximately three times faster than ϵ_t.[1]

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[1] A simple statistical test of the hypothesis that ϵ_t^* grows faster than ϵ_t may be made with

$$3.15 \quad \epsilon_t^* - \epsilon_t = \underset{(27.43)}{\underset{1.28}{(\epsilon_{ot}^* - \epsilon_{ot})}} + \underset{(10.20)}{\underset{0.052}{(\epsilon_{1t}^* - \epsilon_{1t})t}} + v$$

The result leads us to accept the hypothesis.

Table 4

Year	ϵ_t	ϵ_t^*
1953	1.22	2.71
1954	1.22	2.59
1955	1.25	2.65
1956	1.30	2.86
1957	1.43	2.92
1958	1.39	2.99
1959	1.42	3.06
1960	1.44	3.04
1961	1.46	3.18
1962	1.50	3.18
1963	1.49	3.30
1964	1.52	3.39
1965	1.52	3.50
1966	1.53	3.58
1967	1.57	3.81
Average	1.42	3.12

The arithmatic means of the ϵ_t's and ϵ_t^*'s in Table 4 are respectively 1.42 and 3.12, which are close to the figures for ϵ and ϵ^* in Table 1 obtained directly from Equations 3.1 and 3.2.

B. Price Elasticities

Estimation of the price elasticities was undertaken via the same approaches used for the income elasticities.

(i) Aggregate approach

From Equations 3.1-3.2 (see Table 1), the aggregate static price elasticities were obtained. One-tail t-tests at the 5% level for the significance of η and η^* were rejected against the alternative hypotheses that they are both negative. In comparison, the same tests were applied to Houthakker-Magee's results (also shown in Table 1), with 13 instead of our 12 degrees of freedom, and showed that both their η and η^* were significant.

From Equations 3.3-3.4 (see Table 2), we again found η and η^* to be insignificant. Insignificance was also indicated by the same one-tail test when the dynamic formulation of η and η^* was added to that of ϵ and ϵ^*.[1]

(ii) Disaggregate approach

From Equations 3.7-3.8 (see Table 3), it can be seen that 3 of the 8 η_i's and 5 of the 7 η_j^*'s have the right signs and are significantly different from zero.[2]

Equations 3.11-3.12 already discussed above generally failed to establish statistical significance for the η_{1i}'s

[1]Also see note 1 on page 13 above.

[2]The statistical problems with estimating Equations 3.9-3.10 have already been noted above.

and η^*_{1j}'s. We have therefore relied on the results of Equations 3.7 and 3.8.

By using the same method as in the case of income elasticities, each year's aggregate price elasticities η_t and η^*_t were computed indirectly from the disaggregate price elasticities recorded in Table 3. Those price elasticities statistically not significantly different from zero were assumed to be zero. The results are shown in Table 5.

Table 5

year	η_t	η^*_t
1953	-0.49	-1.77
1954	-0.49	-1.81
1955	-0.45	-1.82
1956	-0.61	-1.70
1957	-0.65	-1.64
1958	-0.55	-1.63
1959	-0.63	-1.61
1960	-0.65	-1.62
1961	-0.70	-1.55
1962	-0.63	-1.55
1963	-0.57	-1.49
1964	-0.55	-1.44
1965	-0.53	-1.36
1966	-0.52	-1.36
1967	-0.54	-1.12
Average	-0.57	-1.56

Recall that in Equation 2.12 the aggregate price elasticity was approximately equal to the weighted sum of each commodity group's price elasticity. From the table, we see that the arithmetic means of the elasticities η_t and η_t^* are respectively -0.57 and -1.56, which have the right sign, and are bigger in absolute terms than those obtained by the aggregate approach.

IV. SUMMARY AND CONCLUDING REMARKS

Several tentative conclusions can be drawn from our analysis.

First, we have observed that the disaggregate approach is superior to the aggregate approach in terms of revealing the true income and price elasticities. With the disaggregate approach, we have shown that the derived aggregate elasticities are not constant over time. On the other hand, not only does the aggregate model not show the true elasticities, but it also hides the effect of changes in the composition of imports and exports. The use of the disaggregate approach is therefore consistent with Hick's suggestion of biased growth in considering the "weird case" of changes in the trade balance.

Second, while Houthakker-Magee pointed out the difference between ϵ and ϵ^* in the post-war Japanese economy, we considered additionally the difference between ϵ and ϵ^* in the pre-war period and these parameters in the post-war period. We found that ϵ and ϵ^* generally increased over the fifteen years under consideration, and that the rate of growth of ϵ^* has been faster than that of ϵ. This means that the difference

between ϵ and ϵ^* has become bigger and bigger over time. Although we do not have any exact quality measurement of Japanese products, it seems reasonable to consider that improvement in the quality of Japanese exports has contributed to the increase in ϵ^*. Another way of interpreting our finding is that Japan's experience of rapid growth has contributed to the possibility of a smooth adjustment in terms of her resource allocation toward promising industries characterized by high income elasticities. In other words, it has been possible for the rapid change in the composition of Japanese exports to be accomplished smoothly because of the rapid growth of Japan's economy as well as the growth of ϵ^*.

Third, our derived aggregate η_t^* appears to exhibit some kind of declining trend over time, but the aggregate η_t appears to be relatively constant over time. Within the limited framework of the Marshall-Lerner Condition that $|\eta^* + \eta| > 1$ for a successful revaluation of the yen, our finding shows that this condition is satisfied, although over time there appears to be some tendency for it to be weakened due to the reduction of the absolute value of the sum of η^* and η. However, for considering Japan's role in the recent world currency realignment, our finding is only tentative and should be further verified.

Finally, it should be mentioned that no distinction has been made in our paper between the private and government sectors in Japan. Under this simplified setting, the question of trade restrictions has been ignored from our analysis.

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Statistical Appendix

Table A-1

Symbol / Year	Japan's quantity of import index	Japan's quantity of export index	Japan's import price index	Japan's export price index	Japan's real income index	Japan's wholesale price index	Competitor's export price index	World real income index
	†	†	†	†	††	††	††	††
	M	X	P_m	P_x	Y	P_w	P_x^*	Y^*
1953	31.1	20.7	115.0	112.3	41.0	99.0	93.1	67.0
1954	31.9	27.3	111.7	108.0	44.0	97.0	91.2	69.0
1955	32.6	35.9	112.5	108.5	48.0	96.3	92.2	73.0
1956	40.8	43.4	117.4	113.2	51.0	96.8	96.0	76.0
1957	50.2	47.7	126.6	109.6	57.0	104.0	98.0	78.0
1958	42.4	50.6	106.1	99.8	59.0	97.0	97.0	79.0
1959	53.3	60.1	100.3	103.9	65.0	98.0	96.0	83.0
1960	65.6	69.8	101.6	104.3	74.0	99.0	98.0	87.0
1961	85.6	75.0	100.6	100.1	85.0	100.0	99.0	90.0
1962	84.6	89.2	98.8	97.0	90.0	98.0	99.0	96.0
1963	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1964	115.1	124.0	102.4	100.7	113.0	100.0	101.0	106.0
1965	115.8	160.0	104.6	100.1	118.0	101.0	103.0	112.0
1966	134.0	183.8	105.3	100.2	130.0	103.0	106.0	118.0
1967	169.9	190.3	105.0	100.6	147.0	105.0	107.0	122.0

† Source: United Nations, Statistical Yearbook (various issues).

†† Source: Bank of Japan, Economic Statistics Annual (various issues).

Table A-2

Year \ Japanese Imports	1. Foodstuffs		2. Textile Materials		3. Chemicals and Allied Products		4. Machinery and Equipment	
	M_1	P_{m_1}	M_2	P_{m_2}	M_3	P_{m_3}	M_4	P_{m_4}
1953	34.8	122.0	59.3	132.5	19.7	115.9	47.0	47.8
1954	38.7	114.8	53.0	137.5	18.8	121.5	48.1	51.3
1955	38.4	110.8	53.5	129.1	22.3	123.6	36.5	50.9
1956	35.2	108.0	75.7	120.4	31.1	128.8	48.6	48.0
1957	36.3	108.0	73.7	127.4	35.4	126.9	73.1	56.4
1958	30.3	119.2	65.8	108.9	34.8	117.2	84.2	57.4
1959	32.7	103.4	81.5	92.4	47.9	112.9	79.1	62.8
1960	39.2	95.0	90.2	99.6	58.5	111.1	86.2	66.4
1961	48.1	94.6	109.9	102.2	74.3	110.8	127.1	66.8
1962	54.1	93.2	86.6	101.0	71.5	102.9	157.8	67.5
1963	67.7	109.3	100.9	103.4	86.5	104.5	157.5	71.4
1964	83.4	113.1	95.2	108.3	115.5	97.2	146.6	79.2
1965*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966	113.8	100.2	108.9	100.1	121.3	100.4	113.2	95.3
1967	119.4	102.8	116.0	95.5	151.0	99.1	154.0	90.0

Table A-2 (cont'd)

Japanese Exports / Year	5. Metals and Metal Products		6. Non-metallic Mineral Products		7. Miscellaneous	
	X_5	P_{x_5}	X_6	P_{x_6}	X_7	P_{x_7}
1953	9.4	119.2	26.7	88.0	18.1	86.3
1954	13.7	107.4	32.3	87.9	23.6	85.3
1955	20.9	107.8	43.1	83.5	32.7	82.5
1956	15.3	129.6	54.4	85.8	40.4	84.4
1957	13.5	140.8	55.3	88.1	44.1	87.2
1958	19.5	112.1	52.8	85.2	50.2	82.5
1959	21.5	110.0	63.2	85.6	65.4	82.6
1960	28.8	114.9	73.8	86.4	73.7	82.7
1961	30.5	108.1	74.0	86.4	77.2	82.0
1962	44.4	97.4	76.4	92.9	86.4	81.8
1963	68.3	95.1	86.1	93.1	88.3	84.0
1964	71.1	98.4	96.0	95.1	85.2	100.4
1965*	100.0	100.0	100.0	100.0	100.0	100.0
1966	107.0	96.8	106.0	101.3	107.7	104.0
1967	102.3	101.3	108.2	103.5	161.8	108.2

Source: Bank of Japan, Economic Statistics Annual (various issues).

Note: *Base year.

Table A-2 (cont'd)

Japanese Exports / Year	1. Foodstuffs		2. Textiles		3. Chemicals and Allied Products		4. Machinery and Equipment	
	X_1	P_{x_1}	X_2	P_{x_2}	X_3	P_{x_3}	X_4	P_{x_4}
1953	33.8	92.4	26.8	108.7	8.1	162.2	5.3	131.9
1954	38.0	95.0	39.1	106.4	11.1	157.2	5.9	127.6
1955	44.3	82.8	46.4	102.1	12.8	147.6	8.5	109.8
1956	60.2	82.2	53.5	102.9	14.0	151.6	15.7	113.4
1957	61.1	82.6	62.3	103.1	17.0	145.7	18.3	126.0
1958	80.3	82.4	58.7	96.0	20.7	128.6	17.4	134.0
1959	88.1	82.7	68.1	95.7	27.8	116.3	22.0	137.1
1960	88.1	84.5	75.7	102.2	29.0	114.3	25.9	134.6
1961	83.0	88.2	72.1	101.4	33.6	110.0	33.9	123.5
1962	103.4	95.5	79.7	99.7	48.1	99.2	40.1	117.9
1963	86.5	97.1	76.2	103.4	61.8	93.1	52.5	108.0
1964	95.7	98.2	85.9	105.0	72.0	97.0	73.8	101.3
1965*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966	98.5	114.5	115.3	96.6	131.6	93.0	124.0	101.8
1967	96.7	112.0	109.0	98.8	147.8	84.6	137.3	107.6

Table A-2 (cont'd)

Japanese Imports / Year	5. Mineral Fuels		6. Metal Ores and Scrap		7. Other Crude Materials		8. Miscellaneous	
	M_5	P_{m_5}	M_6	P_{m_6}	M_7	P_{m_7}	M_8	P_{m_8}
1953	12.3	144.8	16.1	105.4	24.3	102.3	12.7	93.2
1954	12.5	131.3	17.9	94.0	26.4	101.3	12.7	86.1
1955	13.4	132.8	17.9	101.7	32.4	111.8	11.9	88.4
1956	16.9	150.5	33.6	133.6	33.9	112.6	24.0	104.7
1957	24.3	172.1	4.6	147.1	37.9	108.3	59.6	118.3
1958	21.1	148.6	25.3	99.7	37.4	91.8	18.4	99.3
1959	26.7	128.6	49.7	97.9	48.1	97.8	29.4	87.3
1960	39.3	116.1	65.5	100.9	56.0	102.1	47.3	90.8
1961	51.7	110.8	91.4	102.6	66.7	97.4	71.9	89.6
1962	58.8	108.9	71.5	97.8	71.6	96.8	56.1	91.7
1963	70.0	106.4	84.1	89.4	88.0	95.5	71.8	86.9
1964	84.7	102.2	99.5	95.8	97.8	94.5	110.9	93.1
1965*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966	114.0	97.3	115.2	102.8	123.5	104.2	117.1	106.4
1967	139.8	98.5	159.6	98.4	141.7	103.9	185.2	112.8

Table A-3

Share of Japanese Imports (%)

Year	Total (thousand U.S. $)	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8
1953	2,409,637	25.9	27.6	3.9	6.7	12.0	7.2	14.0	2.8
1954	2,399,404	27.2	25.8	3.9	7.4	11.1	7.1	15.1	2.4
1955	2,471,430	25.3	23.7	4.5	5.4	11.7	7.5	19.9	2.0
1956	3,229,734	17.3	23.9	5.1	5.0	12.8	14.1	16.0	5.9
1957	4,283,586	13.5	18.6	4.3	6.7	15.9	16.2	13.0	11.9
1958	3,033,125	17.5	20.0	5.5	11.3	17.0	8.5	15.3	5.0
1959	3,599,491	13.8	17.7	6.1	9.8	15.5	13.8	17.7	5.6
1960	4,491,132	12.2	17.0	5.9	9.0	16.5	15.0	17.2	7.3
1961	5,810,432	11.5	16.5	5.8	10.3	16.0	16.5	15.1	8.4
1962	5,636,524	13.1	13.1	5.3	13.6	18.5	12.6	16.7	7.0
1963	6,736,337	16.1	13.1	5.5	11.9	18.0	11.4	16.9	7.1
1964	7,937,543	17.5	11.0	5.9	10.4	17.7	12.2	15.8	9.6
1965	8,169,019	18.0	10.4	5.0	8.7	19.9	12.5	16.6	9.0
1966	9,522,702	17.6	9.7	5.2	8.0	18.9	12.7	18.3	9.6
1967	11,663,087	15.5	7.7	5.2	9.0	19.2	13.7	17.1	12.5

Table A-3 (cont'd.)

Share of Japanese Exports (%)

Year	(Thousand U.S. $)	X_1	X_2	X_3	X_4	X_5	X_6	X_7
1953	1,274,843	9.4	36.1	5.6	14.9	15.1	5.0	14.0
1954	1,629,236	7.6	40.3	5.5	12.5	15.6	4.7	13.9
1955	2,010,600	6.3	37.3	5.1	12.4	19.2	4.6	15.1
1956	2,500,636	6.8	34.8	4.6	19.5	13.7	4.9	15.6
1957	2,858,018	6.1	35.5	4.7	22.2	11.4	4.5	15.6
1958	2,876,560	7.9	31.0	5.1	22.0	13.0	4.1	16.9
1959	3,456,492	7.2	29.8	5.1	23.6	11.8	4.1	18.3
1960	4,054,537	6.3	30.2	4.5	22.9	14.0	4.2	18.0
1961	4,235,596	5.9	27.3	4.8	26.1	13.4	4.0	18.5
1962	4,916,159	6.9	25.6	5.3	25.1	15.1	3.8	18.2
1963	5,452,116	5.3	22.9	5.8	27.0	17.3	4.0	17.8
1964	6,673,191	4.8	21.4	5.7	29.3	18.4	3.6	17.0
1965	8,451,742	4.1	18.7	6.5	31.3	20.3	3.1	16.0
1966	9,776,391	3.9	18.0	6.8	33.8	18.2	2.9	16.3
1967	10,441,572	3.6	16.3	6.6	42.1	17.1	2.8	11.6

Source: Bank of Japan, Economic Statistics Annual (various issues).