PULLING EFFECT AND THE CAPACITY TO FOLLOW: THE CASE OF JAPAN IN EAST ASIA

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THE ECONOMIC IMPACT of Japan on other East Asian countries is rather unique because of her relatively large scale economy[1] as compared to other countries in the region and her continuous rapid expansion.

In this paper a simple model of the pulling effect of Japan's income expansion on other countries in the region and the impact of Japan's export expansion on the export of competitive goods from other countries is developed. In the latter half of the paper remarkable growth rates of Formosa and Korea are explained in terms of the capacity to follow Japan's lead into the world market. This ability is attributable to the human resource endowment as well as historical and institutional environment.

I. A SIMPLE MODEL OF ECONOMIC IMPACT THROUGH TRADING

A. *Demand-Pull Effect*

Let A_i and A_j be sets of exogenous variables for i-th and j-th countries, respectively,

B_i and B_j be sets of structural and behavioral parameters for i-th and j-th countries,

$X_{ij}(Y_j)$ be the export of i to j which depends on the income of j,

$M_{ij}(Y_i)$ be the import of i from j which depends on the income of i.

Then i-th country's income Y_i may be expressed as

$$Y_i = F_i[A_i,\ B_i,\ \sum_{j=1}^{n \neq i} X_{ij}(Y_j),\ \sum_{j=1}^{n \neq i} M_{ij}(Y_i)] \tag{1}$$

and j-th country's income Y_j as

$$Y_j = G_j[A_j,\ B_j,\ \sum_{k=1}^{n \neq j} X_{jk}(Y_k),\ \sum_{k=1}^{n \neq j} M_{jk}(Y_j)]\,. \tag{2}$$

$$j,\ k = 1,\ 2,\ \cdots,\ i-1,\ i+1,\ \cdots,\ n$$

$$k \neq j$$

By substituting (2) in (1)

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1 See Table I for GNP figures.

$$Y_i = F_i[A_i,\ B_i,\ \sum_{j=1}^{n \neq i} X_{ij}(G_j[\cdots]),\ \sum_{j=1}^{n \neq i} M_{ij}(Y_i)]\ . \tag{3}$$

We consider that j's income changes as exogenous changes to i when the size of j is substantially greater than i. By differentiating (3) partially with respect to j-th country's change in income, we obtain

$$\begin{aligned}\frac{\partial Y_i}{\partial Y_j} = &\left(\frac{\partial F_i}{\partial X_{ij}}\frac{\partial X_{ij}}{\partial Y_j}\right) + \left(\frac{\partial F_i}{\partial X_{ik}}\sum_{k=1}^{n \neq i,j}\frac{\partial X_{ik}}{\partial G_k}\frac{\partial Y_k}{\partial Y_j}\right) \\ &+ \left(\frac{\partial F_i}{\partial M_{ij}}\cdot\frac{\partial M_{ij}}{\partial Y_i}\cdot\frac{\partial Y_i}{\partial Y_j}\right) \\ &+ \left(\frac{\partial F_i}{\partial M_{ik}}\sum_{k=1}^{n \neq i,j}\frac{\partial M_{ik}}{\partial Y_i}\frac{\partial Y_i}{\partial Y_j}\right).\end{aligned} \tag{4}$$

The expression (4) can be transformed by utilizing the relationships

$$\left(\frac{-\partial F_i}{\partial M_{ij}}\right) = \left(\frac{-\partial F_i}{\partial M_{ik}}\right) = \left(\frac{\partial F_i}{\partial X_{ij}}\right) = \left(\frac{\partial F_i}{\partial X_{ik}}\right) = K_i \tag{5}$$

$= $ trade multiplier in i-th country

and definitions of income of propensity to import

$$\frac{\partial M_{ij}}{\partial Y_i} = \theta_{ij},\ \frac{\partial M_{ik}}{\partial Y_i} = \theta_{ik},\ \frac{\partial M_{ji}}{\partial Y_j} = \theta_{ji} \tag{6}$$

(θ_{ik} is the income propensity to import of i-th country from k-th country.)

The final expression of j-th expansion (growth), i.e., Japan's expansion on i-th country, i.e., Korea or Formosa, is written as

$$\frac{\partial Y_i}{\partial Y_j} = \left[\frac{\theta_{ji} + \sum_{k=1}^{n \neq i,j}\theta_{ki}\cdot\frac{\partial Y_k}{\partial Y_j}}{\theta_{ij} + \sum_{k=1}^{n \neq i,j}\theta_{ik} + \frac{1}{K_i}}\right] \tag{7}$$

where j stands for Japan, i, k for other countries.

Thus the impact of Japan's income expansion through trading on i-th country is expressed as

$$\left(\frac{\partial Y_i}{\partial Y_j}\right)\left(\frac{dY_j}{Y_i}\right) = \left(\frac{\theta_{ji} + \sum_{k=1}^{n \neq i,j}\theta_{ki}\cdot\frac{\partial Y_k}{\partial Y_j}}{\sum_{k=1}^{n \neq i}\theta_{ik} + \frac{1}{K_i}}\right)\left(\frac{dY_j}{Y_i}\right). \tag{8}$$

According to (7), the degree of the impact of Japan's growth on income in the other country (i) through trade depends upon the respective income propensities in part and the magnitude of the multiplier K_i. When K_i is small and/or the aggregate import propensity of i-th country is large, the impact is small. However, if Japan's (j) import propensity from i as well as the indirect impact of import of all other countries from i are large, the impact will be significant.

If the government of i-th country can control θ_{ik} and/or K_i through tax schemes while Japan maintains free market determined θ_{ji}, the impact can be significant.

Due to the nature of many Asian countries' export goods (basically primary

goods), the income elasticities of demand for these export goods are small. On the other hand, the industrialized nature of Japan's export goods and her locational superiority (compared to other industrialized countries) in Asian markets, θ_{ij} (i-th country's import propensity from Japan) tends to be high. Thus the impact of Japan's growth on other countries in Asia through trade may not be large.

Of course, the second term in the numerator of (7)

$$\sum_{k=1}^{n \neq i,j} \theta_{ki} \left(\frac{\partial Y_k}{\partial Y_j} \right),$$

may be quite significant. This is a term which indicates the size of the sum of exports of i-th country to all other countries due to the income increased in all other countries induced by Japan's expansion.

B. *Effects on Export Expansion*

Let C_j stand for a good C produced in j-th country, C_i stand for a similar good C produced in i-th country. Thus the cross-elasticity of demand for C_i with respect to the change in the price of C in j, i.e., P_j^c is

$$\mu_{ij}{}^C = \frac{dQ_i{}^C}{Q_i{}^C} \Big/ \frac{dP_j{}^C}{P_j{}^C} . \tag{9}$$

The supply elasticities of C_i and C_j are defined as

$$\varepsilon_i{}^C = \left(\frac{P_i{}^C}{dP_i{}^C} \right) \left(\frac{dQ_i{}^C}{Q_i{}^C} \right) \tag{10}$$

and

$$\varepsilon_j{}^C = \left(\frac{P_j{}^C}{dP_j{}^C} \right) \cdot \left(\frac{dQ_j{}^C}{Q_j{}^C} \right) . \tag{11}$$

By simple substitution of (11) into (9) we obtain

$$\left(\frac{dQ_i{}^C}{Q_i{}^C} \right) = \left(\frac{\mu_{ij}{}^C}{\varepsilon_j{}^C} \right) \left(\frac{dQ_j{}^C}{Q_j{}^C} \right) . \tag{12}$$

Similarly,

$$\left(\frac{dP_i{}^C}{P_i{}^C} \right) = \left(\frac{\mu_{ij}{}^C}{\varepsilon_i{}^C \cdot \varepsilon_i{}^C} \right) \left(\frac{dQ_j{}^C}{Q_j{}^C} \right) . \tag{13}$$

II. DEMAND-PULL EFFECT OF JAPAN'S EXPANSION

The pulling effect of Japan's expansion on a country depends upon the propensity to import of Japan from the country as well as aggregate import propensities of the country under consideration (see (8)).

Various propensities to import for selected countries were computed for the year 1968. All data were from "Direction of Trade" and "International Financial Statistics" of IMF. Official exchange rates were used for the conversion of the currency figures to U.S. dollar. Results are listed in Table I.

TABLE I
IMPORT PROPENSITIES, 1968

(U.S.$ Billion)

	Total Import	GNP	$\sum_{k=1}^{n \neq i} \theta_{ik}$	Export to Japan	θ_{ji}*
Formosa	0.903	4.140	0.218	0.151	0.00106
Korea	1.468	5.587	0.263	0.102	0.00071
Malaysia	1.159	3.340	0.347	0.343	0.00240
Philippines	1.280	7.210	0.178	0.398	0.00279
Thailand	1.189	5.070	0.235	0.147	0.00103
Japan	—	142.830	—	—	—

* $\theta_{ji}=\left(\frac{i\text{-th export to Japan}}{142.830}\right)$

The magnitude of crude multipliers (K_i) in various countries were estimated by using the marginal propensities to consume.[2] Since the marginal propensities to consume overestimate the real marginal propensity to consume, the multipliers we obtained may be greater than the real multipliers. However, as a crude estimation these suffice our purpose of illustration. The indirect impact or the secondary effect, $\left(\sum_{k=1}^{n \neq i,j} \theta_{ki} \frac{\partial Y_k}{\partial Y_j} > 0\right)$ is completely neglected so that the estimated results in this section become the minimum estimations. The expression

$$\left(\frac{\partial Y_i}{\partial Y_j}\right)^* = \left(\frac{\theta_{ji}}{\sum_{k=1}^{n \neq i} \theta_{ik} + \frac{1}{K_i}}\right) \quad \begin{array}{l} j = \text{Japan} \\ i = \text{Formosa, Korea, Malaysia,} \\ \quad \text{Philippines, and Thailand} \end{array}$$

were computed by utilizing figures in Table I and K_i's we obtained. Suppose that Japan's GNP (dY_j) expanded by $15 billion[3] in 1969, then the relative expansion of GNP of other East Asian countries could be computed by equation (8).

The figures in Table II are intended to be mere illustrations for the direct impact of Japan's expansion on other East Asian countries. They are not as

TABLE II
POTENTIAL DIRECT IMPACT OF JAPAN'S GNP EXPANSION OF $15 BILLION ON EAST ASIAN COUNTRIES IN 1969

	$\left(\frac{\partial Y_i}{\partial Y_j}\right)^*$	$\left(\frac{\partial Y_i}{\partial Y_j}\right)^*(dY_j)$	$\left(\frac{\partial Y_i}{\partial Y_j}\right)^*\left(\frac{dY_j}{Y_i}\right)$ (%)	Remarks
Formosa	0.00194	29.1	0.70	k=3.061
Korea	0.00139	20.9	0.37	k=4.012
Malaysia	0.00287	43.3	1.30	k=2.049
Philippines	0.00444	66.6	0.92	k=2.221
Thailand	0.00231	34.7	0.68	k=4.782

[2] MPC used in this illustration was the coefficient b in the simple regression $C = a + bY$ where Y is the national income (or GNP) and C is the private consumption.

[3] Japan's growth rate in 1969 is expected to be more than 10 per cent of $143 billion.

significant as we expect them to be.

Formosa and Korea have had tremendous expansion in their foreign trade in the 1960s. A possible reason is that both of these countries were colonial suppliers of many primary products to Japan, and because of this former colonial relationship, they could easily cater to the Japanese taste and expand the export to Japan. For example, Formosan "Ho-Rai" rice and bananas are favorites of Japanese people. But the same relationship also works against them. Koreans and Formosans are accustomed to Japanese products and their income propensity to import from Japan actually counterbalances Japan's import propensity from them. Thus, the export-induced growth[4] of these countries should be explained essentially by the "Capacity to Follow" of these countries rather than the "Pulling Effect" of Japan.

III. THE CAPACITY TO FOLLOW

A. *Human Resources*[5]

Japan's rapid industrialization clearly shows the shifting nature of relative factor endowments among trading countries. In the initial stage of development, Japan concentrated in production of labor intensive products to which her abundant labor amply supplied needed labor services. However, twenty years of sustained expansion depleted available labor supply from the migration of farm labor to urban industrial centers. The situation has been worsening especially in the case of the blue-collar labor supply (basically young men who have less than a high school education). This can be attributed to the decline in the birth rates in the postwar period and the high percentage of teenagers who attend high schools and colleges. In the past two years, the difficulty in recruiting *chu-sotsu* ("middle school graduate") in Japan is comparable to the recruiting of athletes by major colleges in the U.S.A. Gifts and bonuses fly from all directions and many corporations sign up the potential workers long before graduation.[6]

Since 1960, the unemployment rate has been less than 1 per cent in Japan. Of course, the double structure of the Japanese industries is such that supply of and demand for labor in various industries differ according to the company sizes as well as age groups of workers.

Today, Korea and Formosa possess a relatively abundant educated blue-collar labor supply. The population densities of the three countries are Japan, 270/km^2, Korea, 302/km^2 and Formosa, 365/km^2 in 1967. However, unemployment rates in Korea were 6.2 per cent in 1967 while as late as 1963 Formosa had unemployment rates of 6.5 per cent (underestimation is possible because of poor reporting

[4] See Table VII for the rates of expansion of export values.

[5] For the importance of human capital in the explanations of productivity (income) differences, see A. O. Krueger, "Factor Endowments and Per Capita Income Differences Among Countries," *Economic Journal*, Vol. 78 (September 1968), pp. 641–59.

[6] *Asahi shimbun* describes it as *aota-gai* ("buying the rice when it is still green in the paddy") in the editorial page, August 10, 1969. On August 11, 1969, it expressed the desirability to reverse the birth rate upwards.

systems and severe underemployment not reported).

Not only the quantitative abundance of labor exists in these countries, the quality of labor is rather high, especially in the blue-collar labor supply. The measures of the quality of labor are not precise, but some crude statistics may be used as indicators.

Japan's compulsory education was extended to nine years in the postwar period. Korea and Formosa have had compulsory education of six years since the pre-war colonial days under Japan. Recently (1968), Formosa extended the free education (without entrance examination) to nine years.

TABLE III

NUMBER OF STUDENTS (TEACHERS) IN DIFFERENT LEVELS OF SCHOOL

(Unit: 1000)

	Japan (1965)	Korea (1966)	Formosa (1965)
1st: (6 years)	9,775 (347)	5,382 (89)	2,258 (55)
2nd: (6 years)	11,024 (473)	1,369 (38)	664 (26)
general	8,964	1,171 (30)	543 (20)
vocational	2,060	198 (8)	117 (6)
3rd: (4 years)	1,116 (106)	166 (8)	85 (9)
Population	100 million	30 million	13.5 million

Source: *UNESCO Statistical Year Book 1967.*

From the comparison of ratios of primary school enrollment to population of 10 per cent (Japan), 18 per cent (Korea), and 17 per cent (Formosa), the relative shortage of potential blue-collar industrial workers in the near future for Japan is obvious. Japan's high enrollment in secondary schools is due to the compulsory nature of the first three years of the secondary school, but situations in Formosa have vastly changed since 1967 due to the elimination of the entrance examination for the secondary school. This shows that qualitatively Korea and Formosa can supply abundant blue-collar labor who have had minimum necessary education for industrial employment, while Japan is encountering tremendous shortages.

Ratios of vocational high school enrollment to general high school enrollment are also comparable. It is 22 per cent, 17 per cent, and 21 per cent for Japan, Korea, and Formosa, respectively.

In the advanced college training, an interesting comparison of the compositions of college students is made. (See Table IV.)

Korea and Formosa have relatively high science, engineering, medicine and agricultural students. Comparable figures for India was merely 10 per cent for the last three categories.

Korean and Formosan school systems were greatly influenced by the Japanese educational system in colonial days, and in postwar period, all three countries were affected by the American system.

The standards of health also affect the quality of labor. High production of medical personnel may be observed by figures in Table IV for Korea and Formosa. UN statistics report the population per physician ratio of 1,310 for

TABLE IV
COMPOSITION OF COLLEGE STUDENTS

(Unit: 1000)

	Total	Natural Sciences	Engineering	Med.	Ag.	Students / 100,000
Japan (1965)	1,085	39	182	52	38	233
	(100%)	(3%)		(24%)		
Korea (1964)	142	12.5	27	12	14.5	161
	(100%)	(7%)		(29%)		
Formosa (1965)	85	5.5	13	7	5.5	94
	(100%)	(6%)		(30%)		

Source: Computed from *UNESCO Statistical Year Book.*

Formosa, 2,540 for Korea as compared to that of 930 for Japan. These ratios will improve vastly as the numbers of doctors increase.

These figures merely indicate relative abundance of labor as well as the quality of blue-collar labor supply in Korea and Formosa. No implication should be drawn that the technological and scientific development in these two countries are comparable to those of Japan. The essential point is that, given capital investment and the minimum guidance necessary, these two countries can quickly adapt the technological know-how in industrial productions of certain labor intensive export goods as well as import substitutes.

B. *Social Overhead Capital and Political Stability*

The importance of the social overhead capital in economic development is well known. Under a few decades of Japanese colonial control, basic networks of railway transportation as well as road systems and port facilities were constructed. Moreover, the heavy U.S. aid investment in the postwar period improved and added on all these capital stocks.

In the most important sector, the agriculture, these two countries had a long head start in adapting the modern irrigation as well as the fertilizer applications, as compared to other Asian countries. High productivity as well as the increase in productivity in agriculture are important sources of industrial workers. The improvement in productivity has been greatly facilitated by the land reform and the extention work carried out by numerous agricultural coops.

TABLE V
FERTILIZER—IRRIGATION AND YIELDS

	Yield	Irrigated Land (%)	Fertilizer (kg/ha)
Formosa	37	58.9	255.8
Korea	23	57.0	166.8
Thailand	16	18.3	2.9
Philippines	10	12.1	17.4
India	9	16.1	5.4

Source: ECAFE, *Economic Survey of Asia and Far East, 1967*, Bangkok, 1968.

TABLE VI
AGRICULTURE PRODUCTIVITY: RICE (ton/ha)

	1962	1966	Change
Korea	3.58	4.26	+.68
Formosa	3.31	3.75	+.44
Thailand	1.50	1.72	+.22
Philippines	1.25	1.35	+.10
India	1.37	1.28	−.08

Source: ECAFE, *Economic Survey of Asia and Far East, 1967*, Bangkok, 1968.

The following figures indicate the capacity of these countries in improving the agriculture productivity.

Another factor which is conducive to the fast development is political stability. Needless to say, Japan has had a conservative party in power throughout the postwar period except for a short period in which the socialist party under Katayama was in power.

Korea's political situation has been rather stable since Park took over. He has executed his pro-growth economic plans without open revolt. In Formosa, the Kuomintang government under Chiang Kai-shek has provided a "domestic stability" under the name of martial law.[7] Both Korean and Formosan governments provide pro-investment and growth-biased treatment for big business and foreign investments.

Last but not least important factor is the adaptability of technology. Many institutional setups in Korea and Formosa have been molded after the Japanese and the Japanese language is the most widely used "foreign language." These are reasons why many types of Japanese "know-how" have been adopted in Korea and Formosa, e.g., shipbuilding, without excessive difficulties.

IV. EXPANSION OF THE EXPORT MARKET

Besides the direct and indirect pulling effects of Japanese expansion, these two countries' ability to follow Japan into the world market by taking full advantage of the shift in factor intensities, e.g., labor has provided a phenomenal growth of their foreign trade.

The figures in Table VII clearly indicate the fantastic growth of export of Formosa and Korea as compared to that of the amazing growth of Japan's export. Japan's import has kept up with export growth due to liberalization of trade. However, Formosa and Korea still use rather strict import controls.

A possible explanation is that, as Japan keeps expanding her world export market, the labor shortage becomes more and more acute and the production cost of labor intensive export goods have been greatly affected. As explained in III, Formosa and Korea possess the capacity to absorb the know-how of most of the labor intensive productions. In many cases, they moved into markets

[7] This only implies that any open revolt or workstoppage is not allowed.

TABLE VII
AVERAGE GROWTH RATE (%) OF REAL GDP AND ITS COMPONENTS (1960–66)

	Total	Per Capita	C	G	I	X	M
Japan	9.6	8.5	8.9	7.2	10.7	15.5	13.2
Formosa	10.4	7.5	8.8	3.9	13.9	21.0	13.0
Korea	7.9	5.1	6.1	3.8	20.3	27.7	14.0

Source: *U.N. Statistical Year Book, 1968.*

previously opened by Japan by sheer low cost (price) as in the cases of textile products and transistor products. As the tempo of the Japanese expansion has increased, export goods production in Japan have been shifted from the labor-intensive to more capital-intensive goods. Formosa and Korea have moved into markets in which Japan's strength has weakened due to high labor cost. Moreover, the capacity to follow of Korea and Formosa has been greatly bolstered by the foreign investment, especially Japanese and American, as the abundance of educated workers as well as relative political stabilities have attracted the capital inflows.

The substantially higher growth rates of exports in Formosa and Korea as compared to that of Japan may be explained as follows:

1. In many export goods Formosan and Korean products are very close substitutes for Japanese products (can you tell the difference between Korean shirts and Japanese shirts sold in department stores without looking at labels?). This means that the cross elasticities between large numbers of Japanese and Korean and/or Formosan products are very high, i.e., μ_{ij}^c is large where j is Japan and i represents Formosa or Korea.
2. Because of the acute shortage of labor services, supply functions of many Japanese export goods with high labor intensities are upward sloping, i.e., ε_j^c is small.

That is the supply functions are rather inelastic as compared to those in Korea and Formosa where labor supply is still abundant[8] (i.e., ε_i^c is very large). Thus we conclude $\mu_{ij}^c/\varepsilon_j^c$ is much greater than unity. As the Japanese world market expands (dQ_j^c/Q_j), the percentage increase in the export of competitive goods from Formosa and Korea will be many times higher than that of Japan (see equation (12)). In many extreme cases, Formosa and Korea may actually become dominant suppliers, e.g., low priced transistor radios and low priced toys.

Some evidences are presented in Table VIII.

Korea's export to North America had an eighteenfold increase of 1962–68 period and Formosa's export to North America was sixfold as compared to that of Japan's 291 per cent. The same situation holds in the case of exports to the Common Market and Africa even though the difference was smaller.

Conclusion: The dynamic expansion of Japan's economy has had some pulling effect on other countries in East Asia but the human resource endowment and

[8] Monthly wages in manufacturing sector were estimated from U.N. data as $37, $25, and $130 for Formosa, Korea, and Japan.

TABLE VIII

EXPORT EXPANSION OF FORMOSA, KOREA AND JAPAN

(U.S.$1 Million)

Export Market	Formosa		(%)	Korea		(%)	Japan		(%)
	1962	68	68/62	62	68	68/62	62	68	68/62
1. U.S. and Canada	55.6	330.7	(600)	12.1	217.1	(1,800)	1,536.8	4,479.1	(219)
2. Common Market	14.0	56.5	(404)	4.1	19.7	(469)	272.5	686.7	(252)
3. Oceania	—	—	—	0	3.5	(∞)	225.4	684.9	(304)
4. M.E.	4.2	10.1	(240)	0	5.9	(∞)	165.8	463.6	(281)
5. Other African	2.9	12.8	(489)	0.1	10.5	(10,500)	254.9	720.1	(283)
6. Other Asia	80	195.7	(245)	12.2	43.9	(360)	1,473.1	3,613.1	(245)
7. Japan	52.2	121.1	(232)	23.5	87.1	(370)	—	—	—

Source: Computed from data in "Direction of Trade," IMF.

other institutional (or historical) factors have provided Formosa and Korea superior capacity to follow Japan's lead into the world's major markets. This explains partially these two countries' impressive performances in the 1960s.