

Title	Economic Development and Unequal Exchange among Nations Analysis of the USA, Japanese and South Korean Economies for the Years 1960-1985 Using Total Labor Inputs
Author(s)	NAKAJIMA, Akiko; IZUMI, Hiroshi
Citation	The Kyoto University Economic Review (1995), 64(2): 33-48
Issue Date	1995-09
URL	<a href="http://hdl.handle.net/2433/44269">http://hdl.handle.net/2433/44269</a>
Right	
Type	Departmental Bulletin Paper
Textversion	publisher

# **Economic Development and Unequal Exchange among Nations**

## **– Analysis of the USA, Japanese and South Korean Economies for the Years 1960 – 1985 Using Total Labor Inputs –**

*by* Akiko NAKAJIMA\* and Hiroshi IZUMI\*\*

### **I Introduction (Objective of this Paper)**

There has been much talk about unequal exchange of labor among nations, but there have not been any empirical studies of this matter. The aim of this paper is to provide evidence concerning the existence of unequal exchange among nations for the case of the USA, Japan and the Republic of Korea (hereafter abbreviated as ROK).

In order to measure the degree of unequal exchange of labor among nations, we first calculated the total labor input of each industry for each nation for each year. For this calculation each country's input output tables were used. Then the total labor input embodied in each nation's average exports and in its exports to a particular nation were calculated. The UN Commodity Trade Statistics and the export column within the columns of final demands of the input output tables were used for this calculation. Finally, such labor contents were compared among nations.

### **II Model**

#### **2.1 Assumptions**

In order to calculate the total labor inputs of each industry for the USA, Japan and ROK, the following assumptions are employed.

- (1) All labor is regarded as necessary labor. That is, all labor employed including that in the service sector is counted.
- (2) Actual depreciation costs are assumed to equal the value of depreciation allowances.

---

\* Lecturer, Faculty of Economics, Kyoto University.

\*\* Professor, Osaka University of Economics.

Izumi did all the data processing and calculated Table 1. Nakajima arranged the SITC codes into input output classification. Then Izumi calculated table 2. Other tables and figures were prepared by Nakajima. The entire paper is written by Nakajima. Data sources is written by Izumi.

- (3) The labor embodied in imported inputs are replaced by the labor embodied in the same value of exports.
- (4) The economy is classified into 24 sectors. The classification employed is that used in "The 1985 Japan U.S. EC Asia Input Output Table" published by the Ministry of International Trade and Industry of the Government of Japan.

## 2.2 Basic theoretical definition<sup>1)</sup>

The total labor inputs of commodities produced in sector  $j$  is theoretically defined as follows:

$$t_j = \sum_i a_{ij}t_i + l_j \quad (1)$$

This can be written in vector form as follows:

$$T = TA + L \quad (2)$$

### 2.3.1 Monetary expression

Interindustry transaction tables are available only in monetary terms. Therefore the actual measured total labor inputs is as follows:

$$\frac{t_j}{p_j} = \sum_i a_{ij} \frac{p_i}{p_j} \frac{t_i}{p_i} + \frac{l_j}{p_j} \quad (3)$$

Asterisks will be suffixed to indicate monetary expressions. Thus, equation 3 in vector form is as follows:

$$T^* = L^*(I - A^*)^{-1} \quad (4)$$

### 2.3.2 Consideration of depreciation of fixed capital as a cost

Depreciation of fixed capital is added to intermediate inputs as a cost. For this calculation, depreciation allowances are assumed to be equal to actual depreciation costs. Then total depreciation costs are distributed among sectors according to the size of their capital stock in the capital formation table.

$$d_{ij} \frac{p_i}{p_j} = \frac{Z_j}{X_j} \frac{K_{ij}p_i}{\sum_i (K_{ij}p_i)} \quad (5)$$

$$\frac{t_j}{p_j} = \sum_i \left( \left( a_{ij} \frac{p_i}{p_j} + d_{ij} \frac{p_i}{p_j} \right) \frac{t_i}{p_i} \right) + \frac{l_j}{p_j} \quad (6)$$

$Z_j$  is the depreciation allowance of sector  $j$ ,  $X_j$  is the value of total production of sector  $j$ , and  $K_{ij}P_i$  is the value of the stock of the  $i$ -th capital good used in sector  $j$ .

### 2.3.3 Evaluation of imported inputs

We have to calculate the total labor inputs of each industry's output. For this calculation, the foreign labor embodied in imported inputs is replaced by national (domestic) labor. For this replacement, the labor content of imported inputs is replaced by the total amount of national (domestic) labor embodied in the same value of exports.

1) Please refer to the list of notations.

Input output tables of the non-competitive import type are used for this replacement in the case of Japan and ROK. In the case of the USA where only non-competitive import type transaction tables are available, domestic input coefficients are calculated assuming (i) there are no re-exports, and (ii) the ratio of imports to domestic produced goods is the same for intermediate demands and for final demands.

### 2.3.3.1 Okishio's modelling

The determination of total labor inputs after taking account of imported inputs is as follows:

$$T^* = T^*(A^{d*} + D^*) + M^*t^{m*} + L^* \quad (7)$$

$$t^{m*} = T^* \cdot \acute{E}^* \quad (8)$$

The above equations can be transformed as follows:

$$T^* = (L^* + M^*t^{m*})(I - A^{d*} - D^*)^{-1} \quad (9)$$

$$t^{m*} = \frac{L^*(I - A^{d*} - D^*)^{-1} \cdot \acute{E}^*}{1 - M^*(I - A^{d*} - D^*)^{-1} \cdot \acute{E}^*} \quad (10)$$

where  $t^{m*}$  is a scalar and both nominator and denominator of (10) are scalars. The method of calculation is to calculate  $T^{d*} = L^*(I - A^{d*} - D^*)^{-1}$ , then equation (10), and finally equation (9).

### 2.3.3.2 Nakajima's Method

On the other hand, because  $t^{m*}$  is a scalar (7) and (8) can be transformed as follows:

$$T^* = L^*(I - A^{d*} - D^* - \acute{E}^*M^*)^{-1} \quad (11)$$

Estimations based on (9) (10), and (11) give the same results.

### 2.3.3.3 Izumi (Wolff)'s method

Add a row vector of import input coefficients below an ordinary input output coefficient matrix, and add a column vector of export components to the right of the matrix. This will give a square matrix of size  $n+1$ .

$$\begin{pmatrix} \alpha^*_{11} & \alpha^*_{1n} & e^*_1 & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ \alpha^*_{nl} & \alpha^*_{nn} & e^*_n & \vdots \\ m^*_1 & \dots & m^*_n & 0 \end{pmatrix} \quad (12)$$

where  $\alpha^*_{ij} = \alpha^{d*}_{ij} + d^*_{ij}$  for any  $i, j$ .

Set the  $(n+1)$ th factor of the direct labor coefficient vector to 0 and calculate the total labor inputs as if the number of sectors were equal to  $n+1$ . When the  $(n+1)$ th sector's total labor inputs is denoted as  $t^{m*}$ , what we are calculating is as follows:

$$\frac{t_j}{p_j} = \sum_i \left( a_{ij} \frac{p_i}{p_j} + d_{ij} \frac{p_i}{p_j} \right) \frac{t_i}{p_i} + m^*_j t^{m*} + \frac{l_j}{p_j} \quad (13)$$

Table 1

		U.S.A.					
		Total Labour Inputs by Industry					
		Unit: Man hour/1000 US Dollar					
		1960	1965	1970	1975	1980	1985
1	Agriculture, forestry, fishery	494.86	368.11	250.86	154.48	110.22	83.77
2	Mining	240.47	191.92	150.85	77.82	45.59	38.40
3	Foodstuffs	338.05	255.76	183.12	114.86	88.43	62.90
4	Textiles	381.83	300.40	227.31	160.69	106.51	79.41
5	Pulp, paper, wood products	340.37	254.57	199.32	132.83	86.69	65.23
6	Chemicals	237.52	178.22	148.00	95.26	71.59	50.74
7	Oil products	221.53	169.59	138.17	89.32	56.34	40.77
8	Ceramics, sand and stone	272.35	219.95	162.76	119.80	79.25	57.55
9	Iron and steel, iron and steel products (including coke)	250.09	196.97	155.60	100.62	76.79	52.20
10	Nonferrous metals	259.00	202.23	189.58	117.23	83.51	67.78
11	Metal products	289.10	223.75	180.34	109.28	79.20	56.65
12	Ordinary machinery	275.94	212.85	169.03	101.08	68.65	50.77
13	Electric machinery	279.80	205.78	153.34	137.18	94.29	72.03
14	Automobiles	259.59	195.41	155.85	106.28	79.21	53.41
15	Other transport machinery	269.86	217.45	180.80	123.03	79.23	57.88
16	Precision machinery	295.52	225.25	181.71	120.31	80.24	62.68
17	Other manufactured goods	288.46	215.54	178.61	122.21	80.36	58.41
18	Construction	278.81	220.10	170.29	111.51	78.61	58.63
19	Electric power, tap water, gas	229.75	171.97	159.07	101.53	67.86	42.47
20	Commerce	351.45	276.90	206.78	160.59	97.31	80.00
21	Transportation	306.94	242.75	187.02	128.84	81.44	59.30
22	Other services	273.49	205.78	154.02	114.24	75.33	54.30
23	Government activities	340.39	269.38	210.22	72.05	50.88	34.20
24	Activities not elsewhere classified, others	293.57	218.75	0.00	285.59	199.77	140.93
25	Imports	281.43	236.71	179.70	124.07	84.78	60.92

$$l^{m*} = \sum_i e_i^* \frac{t_i}{p_i} \quad (14)$$

These equations are equal to the Okishio's definitions given earlier and therefore Izumi (Wolff)'s method gives the same results. When we use Izumi (Wolff)'s method we have to calculate an inverse matrix of size  $n+1$ . However, this method is very simple, and the total labor input of imports (exports) are calculated together with all the other total labor inputs of each sector.

### List of notations

$A$  Input output coefficient matrix in physical terms

$A^*$  Input output coefficient matrix in monetary terms, i.e.,  $a_{ij}^* = a_{ij} \frac{p_i}{p_j}$

$A^{d*}$  Input output coefficient matrix of domestically produced inputs only, i.e.,  $A^* = A^{d*} + A^{m*}$

$A^{m*}$  Input output coefficient matrix of imported inputs only

$D$  Depreciation coefficient matrix of fixed capital

Table 1

Japan Total Labour Inputs by Industry Unit: Man hour/1000 Dollar						
	1960	1965	1970	1975	1980	1985
1	5385.43	2741.15	1726.64	609.75	331.00	277.01
2	2597.90	1429.95	644.59	265.50	114.72	111.12
3	3600.82	1889.04	1033.19	397.47	189.17	160.27
4	3609.63	1087.65	1099.52	418.96	196.06	181.36
5	3693.95	1867.37	890.34	349.10	170.04	135.85
6	2412.67	1288.40	558.10	245.58	119.52	95.55
7	1609.56	857.27	386.51	234.84	116.60	90.79
8	2626.90	1434.39	677.64	281.49	134.79	112.29
9	2184.98	1308.96	550.89	237.08	110.00	93.08
10	2897.74	1331.52	610.23	244.27	116.04	106.95
11	2576.99	1450.03	663.73	281.55	140.97	121.45
12	2376.81	1326.48	586.52	260.32	128.84	104.92
13	2439.32	1377.09	640.64	280.95	129.50	113.07
14	2441.83	1317.73	634.72	242.36	128.81	108.84
15	2356.84	1352.05	655.05	256.10	128.90	106.72
16	2595.05	1507.48	711.77	294.70	140.47	117.23
17	3119.63	1667.71	782.71	315.75	153.41	124.03
18	2989.43	1642.87	751.46	301.09	152.86	136.86
19	1960.80	1058.09	483.78	220.73	102.97	91.05
20	3663.99	1845.59	864.66	366.68	170.16	154.82
21	2523.55	1442.61	728.99	280.21	141.28	123.92
22	2439.89	1275.21	646.82	242.32	126.71	107.65
23	1611.65	1138.29	628.52	235.45	134.69	113.51
24	2884.77	1601.70	604.43	290.87	138.67	109.54
25	2982.71	1550.34	710.00	274.83	134.90	114.91

$T$  Total labor input vector (row vector) in physical terms

$T^*$  Total labor input vector (row vector) in monetary terms i.e.,  $t_j^* = \frac{t_j}{p_j}$

$L$  Direct labor input coefficient vector (row vector)

$L^*$  Direct labor input coefficient vector in monetary terms (row vector) i.e.,  
 $l_j^* = \frac{l_j}{p_j}$

$M^*$  Import input coefficient vector ( $1 \times n$  row vector) i.e.,  $m_j = \sum_i a^{m*}_{ij}$

$E^*$  Export component vector ( $1 \times n$  column vector) i.e.,  $e_j^* = \frac{E_j^*}{\sum_i E_j^*}$   $e_j^*$  is the share of exports from sector  $j$  in total exports

$$\sum_j e_j^* = 1$$

$t_m^*$  Total labor input embodied in one monetary unit of imports (scalar)

Table 1

Republic of Korea						
Total Labour Inputs by Industry						
Unit: Man hour/1000 US Dollar						
	1960	1965	1970	1975	1980	1985
1	10197.97	9442.81	4292.14	2234.46	942.60	646.52
2	2647.85	4438.84	2316.40	1391.06	527.18	482.04
3	4850.93	5672.8	2466.79	1410.59	697.07	492.65
4	4370.25	5914.62	2872.24	1922.57	711.27	547.18
5	5812.13	5200.91	2564.04	1586.00	638.09	463.93
6	3746.71	4405.93	1996.20	1301.66	470.10	378.62
7	0.00	3399.11	1846.02	1287.96	531.02	392.92
8	3437.50	4714.29	2112.68	1325.79	513.60	409.26
9	3089.31	4678.68	2206.59	1401.18	512.37	404.03
10	2766.49	4690.47	2239.04	1299.48	568.43	433.32
11	3671.67	5608.86	2757.58	1549.58	559.88	421.91
12	3528.25	5176.56	2507.72	1444.61	533.30	416.69
13	3843.06	4755.53	2296.69	1406.21	574.66	443.32
14	0.00	0.00	2098.27	1371.08	555.11	388.17
15	3540.24	4055.00	2323.62	1416.46	526.47	420.10
16	0.00	0.00	2574.26	1585.17	581.89	468.71
17	3708.02	5257.65	2805.10	1686.69	671.11	483.36
18	3860.32	4683.91	2176.06	1407.27	492.30	402.52
19	2654.65	3063.28	1224.91	1111.67	401.62	287.97
20	4958.99	6028.02	2649.25	1439.87	708.74	593.77
21	3648.61	4454.84	2199.60	1455.13	528.54	420.70
22	2553.41	5145.54	2547.35	1476.14	547.42	409.07
23	0.00	0.00	0.00	0.00	542.16	416.98
24	2020.92	5202.96	2472.37	1426.26	644.64	508.00
25	4938.34	5411.7	2670.56	1636.38	620.42	470.18

### III Findings

The total labor inputs of each industry for the U.S.A., Japan and ROK were calculated for the years 1960,65,70,75,80 and 1985 as can be seen in Table 1. Then, the average labor content of each country's exports were calculated using the export column vector within the final demands and the UN Commodity Trade Statistics. From such calculations, we obtained the following findings.

#### 3.1. Existence of clear unequal exchange of labor

The average labor inputs embodied in exports are shown in Table 2. The first row shows the average labor inputs embodied in the exports of the U.S.A. to all countries, and the second and third rows indicate the average labor inputs embodied in the exports of the U.S.A to a particular country (in this case to Japan and ROK.)

The ratio of these labor inputs were calculated and are shown in Table 3 and in Figure 1. This figure shows clearly the existence of the unequal exchange of labor. The degree of unequal exchange was great in the past (as high as 24 times between the U.S. and R.O.K and 10 times between the U.S. and Japan). Such unequal exchange of labor in exports still exists at present.

Table 2 Average Total Labour Inputs in Exports

unit: Man×Hour/1000 dollars

		1960	1965	1970	1975	1980	1985
U.S.A.	Total Exports	281.43	236.71	179.70	124.07	84.78	60.92
	Exports to Japan	350.90	275.78	192.05	123.60	86.65	64.07
	Exports to R.O.K.	330.05	273.03	201.40	135.42	90.85	65.04
Japan	Total Exports	2995.80	1550.34	710.00	274.83	134.90	114.91
	Exports to U.S.A.	3029.97	1600.38	712.09	271.22	131.75	111.67
	Exports to R.O.K.	2639.86	1507.39	864.39	282.39	135.21	111.70
R.O.K.	Total Exports	4938.34	5411.70	2670.56	1636.38	620.42	470.18
	Exports to U.S.A.	6221.34	5804.56	2780.86	1704.38	635.58	479.30
	Exports to Japan	6108.53	6804.88	2961.10	1784.32	688.16	490.77

Table 3 Ratio of Labor Embodied in Export (Degree of Unequal Exchange among Nations)

	1960	1965	1970	1975	1980	1985
Japan/U.S.A.	10.64	6.55	3.95	2.22	1.59	1.89
(J→U.S.)/(U.S→J)	8.63	5.80	3.71	2.19	1.52	1.74
Korea/U.S.A.	17.55	22.86	14.86	13.19	7.32	7.72
(K→U.S.)/(U.S→K)	18.85	21.26	13.81	12.59	7.00	7.37
Korea/Japan	1.65	3.49	3.76	5.95	4.60	4.09
(K→J)/(J→K)	2.31	4.51	3.43	6.32	5.09	4.39

In the process of making Table 2 and Table 3, exchange rates (between currencies) were used. It may be worth noting that the Korean currency has depreciated 400% against the U.S. dollar between 1960 and 1965, and continued to depreciate until 1980.

A comparison of the average labor inputs of exports with the average labor inputs of all industries indicates that industries that have a comparative advantage are not always the export industry.

### 3.2 Unequal exchange decreases as a result of economic development

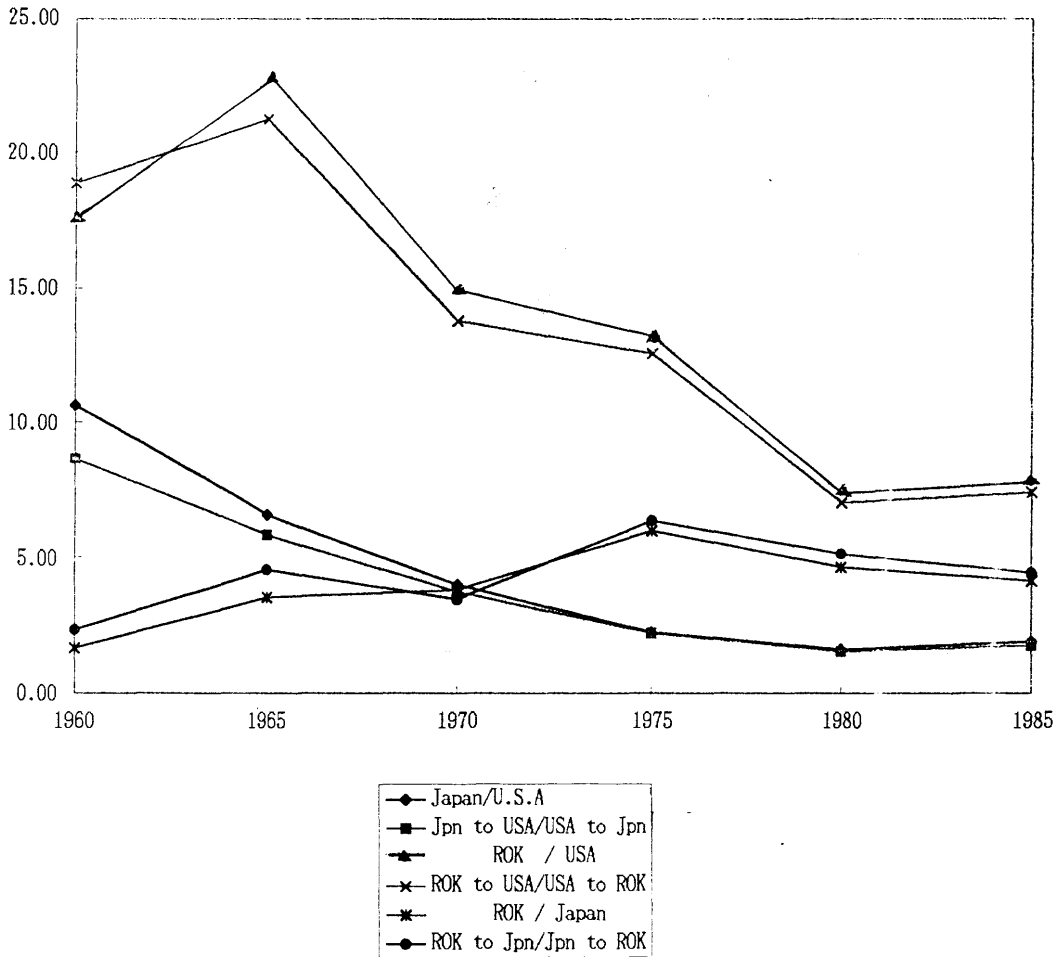
The degree of unequal exchange of labor of exports are measured by the ratio of the total labor inputs of exports (Figure 1).

It is clear that the Japanese and Korean economies have developed at a much higher speed than the U.S. and that the degree of unequal exchange has declined (Figure 1).

The degree of unequal exchange between ROK and Japan has improved since 1975 (Figure 1). Japanese economic growth slowed down from about this year, so the relative economic development of Korea became more significant. (Please refer to Table 6)



Figure 1 Degree of Unequal Exchange Among Nations



### 3.3 Factor analysis

The unequal exchange of labor can be decomposed into three factors: namely, (i) differences of labor productivity, (ii) differences in prices including differences in existing exchange rates and PPP exchange rates and (iii) differences in the composition of exports.

### 3.4 Unequal exchange of labor among industries within a nation

Basically, it is difficult to make statements about the unequal exchange of labor among different industries within a nation. Two indicators of the degree of unequal exchange among industries were formulated.

The first indicator is

$$\frac{\sqrt{\sum_i (t_i - \bar{t})^2 / n}}{\bar{t}} \times 100 \quad (15)$$

$$\bar{t} = \frac{\sum_i t_i}{n} \quad (16)$$

The second indicator is

$$\frac{\sqrt{\sum_i ((t_i - \bar{t})^2 \frac{x_i}{\sum_i x_i})}}{\bar{t}} \times 100 \quad (17)$$

$$\bar{t} = \sum_i (t_i \frac{x_i}{\sum_i x_i}) \quad (18)$$

where  $X_i$  is total outputs of sector  $i$ .

The degree of unequal exchange among industries was measured by indicator (1) in Table 4, and by indicator (2) in Table 5.

These two indicators show that (i) the unequal exchange of labor among industries within the U.S.A is low. (ii) There is a decreasing trend of unequal exchange in the case of ROK. The first finding may be related to the fact that there is not a big difference in the total labor inputs of the agricultural sector and the non-agricultural sector in the case of the U.S.A. The second finding may be partly due to the fact that the economic situation and thus the sectoral composition of R.O.K. was very different in 1960, as a result of which the degree of unequal exchange was high to begin with.

Table 4 Degree of Unequal Exchange among Industries (1)

	1960	1965	1970	1975	1980	1985
U.S.A.	19.58%	19.18%	25.90%	32.88%	33.63%	33.45%
Japan	28.56%	24.79%	35.44%	27.76%	30.59%	30.77%
R.O. Korea	64.66%	45.78%	30.61%	25.96%	18.27%	16.31%

Table 5 Degree of Unequal Exchange among Industries (2)

	1960	1965	1970	1975	1980	1985
U.S.A.	19.66%	18.95%	15.24%	20.65%	19.16%	22.13%
Japan	29.66%	25.25%	33.69%	27.37%	26.58%	26.58%
R.O. Korea	55.18%	31.09%	33.21%	24.67%	21.38%	18.02%

Table 6

U.S.A. Value of Total Output Unit: Million U.S. Dollars						
	1960	1965	1970	1975	1980	1985
1	52,671	59,709	75,663	118,457	174,460	191,098
2	17,658	20,757	26,906	58,482	147,757	165,084
3	74,237	88,226	123,964	189,184	273,801	325,169
4	31,864	41,954	54,384	65,423	101,357	115,653
5	28,202	39,928	50,295	77,101	138,764	172,120
6	27,738	40,258	54,834	88,990	172,573	206,162
7	18,968	23,530	29,357	68,348	190,587	175,585
8	10,591	13,435	19,424	26,258	45,223	53,492
9	20,801	27,103	40,052	52,656	77,459	61,139
10	10,651	16,028	20,197	29,445	58,355	48,287
11	21,547	31,176	42,599	63,407	108,784	128,782
12	27,296	44,166	60,981	91,705	177,772	205,664
13	25,437	39,971	60,528	62,633	131,575	195,699
14	26,817	41,537	48,365	70,837	103,630	187,244
15	17,179	24,278	29,205	39,197	78,747	98,501
16	6,173	8,665	13,144	19,139	37,726	51,089
17	36,752	51,990	72,865	76,045	138,657	198,372
18	74,159	94,297	126,191	194,589	367,669	491,748
19	29,750	41,807	48,090	99,656	205,307	316,980
20	105,180	141,989	204,702	273,694	563,235	727,513
21	35,693	44,830	62,104	97,920	187,926	241,393
22	219,250	305,269	466,611	793,753	1,463,532	2,384,970
23	44,425	68,342	109,842	172,650	280,056	406,738
24	2,793	1,242	0	6,519	8,872	13,025
25	97,590	31,490	49,766	123,464	254,275	261,352
Sum	965,832	1,310,487	1,840,303	2,836,088	5,233,824	7,161,507
Growth Rate		1.36 2.65%	1.40 2.95%	1.54 3.76%	1.85 5.32%	1.37 2.72%

Table 6

Japan						
Value of Total Output						
Unit: Million Yen						
	1960	1965	1970	1975	1980	1985
1	3,112	4,746	7,114	13,038	16,111	17,746
2	380	574	959	1,511	2,601	1,925
3	3,739	5,935	9,876	19,008	26,954	37,227
4	2,305	3,511	5,928	9,055	11,670	13,444
5	1,743	3,353	6,980	10,925	17,415	16,894
6	1,462	2,874	5,917	11,019	19,685	22,868
7	381	1,031	2,373	7,788	15,437	16,085
8	523	1,024	2,670	4,875	8,255	8,556
9	2,918	4,419	11,904	21,021	31,415	27,314
10	582	960	2,508	3,095	7,036	6,295
11	410	947	3,505	6,254	10,409	11,588
12	1,361	2,370	7,472	11,213	18,770	26,405
13	1,225	2,134	7,104	10,369	22,178	38,887
14	1,153	2,560	6,761	13,961	25,827	33,372
15	467	936	1,806	3,549	4,171	5,355
16	171	397	946	1,614	3,428	4,045
17	1,088	2,295	5,180	10,128	18,048	24,283
18	3,181	6,640	16,259	34,074	55,257	56,018
19	649	1,311	2,628	6,642	14,751	20,484
20	2,609	5,939	14,290	30,053	51,518	61,148
21	1,618	3,259	6,597	20,706	35,250	27,456
22	4,902	11,547	26,991	67,639	118,163	169,966
23	825	1,281	2,251	8,581	13,275	17,057
24	1,925	2,984	6,664	12,816	17,604	20,398
25	1,720	3,431	8,545	20,077	34,543	47,545
Sum	38,828	73,027	164,680	338,932	565,226	684,815
Growth Rate	1.88 5.49%	2.26 7.06%	2.06 6.27%	1.67 4.44%	1.21 1.67%	

Table 6

R.O. KOREA						
Value of Total Output						
Unit: Million Won						
	1960	1965	1970	1975	1980	1985
1	95,003	402,903	932,408	2,987,441	7,797,221	14,643,322
2	7,090	24,797	61,481	213,730	737,750	1,353,537
3	35,176	128,765	452,597	1,281,368	10,072,488	17,363,056
4	26,511	115,101	378,142	2,074,523	7,128,425	12,731,603
5	7,345	38,454	122,390	476,883	1,975,444	3,510,149
6	5,146	29,828	170,965	1,255,866	5,570,552	9,293,053
7	0	12,302	93,943	905,574	4,531,838	7,098,726
8	3,810	17,884	75,650	338,418	1,762,679	3,376,353
9	6,817	33,728	128,887	796,004	4,967,982	9,452,672
10	734	4,396	14,381	90,762	574,653	1,211,161
11	3,384	9,768	32,044	193,591	1,176,500	3,204,901
12	2,995	9,562	26,273	177,397	1,305,370	4,354,592
13	853	11,491	63,288	680,791	3,494,830	8,455,073
14	0	0	63,312	204,388	918,493	3,019,704
15	2,643	18,961	27,552	217,776	755,734	3,021,488
16	0	0	7,335	57,751	367,564	739,164
17	13,065	46,925	144,748	738,815	3,329,722	8,834,040
18	20,244	100,332	475,197	1,409,900	7,492,407	15,462,488
19	7,954	18,100	65,444	342,317	2,016,033	4,459,418
20	26,774	137,478	492,540	1,887,900	6,627,864	12,522,517
21	17,215	61,105	271,642	1,043,940	4,909,638	9,208,151
22	65,907	166,412	638,241	2,214,550	11,198,540	27,995,888
23	0	0	139,644	399,931	3,416,597	6,264,846
24	7,116	44,184	148,762	460,734	1,509,200	3,088,075
25	9,676	86,036	376,004	2,824,499	12,467,197	27,716,992
Sum	355,782	1,432,476	5,026,866	20,450,350	93,637,524	190,663,977
Growth Rate	4.03	3.51	4.07	4.58	2.04	
	12.10%	10.90%	12.19%	13.21%	6.18%	

#### IV Conclusion

Our findings confirm the existence of unequal exchange of labor among nations and show that such unequal exchange among nations decreases along with economic development in the case of the U.S.A., Japan and R.O. Korea.

#### References

- [ 1 ] Emmanuel, A., *Unequal Exchange*, Francois Maspero, Paris, 1970.
- [ 2 ] Evans, D.H., 'Alternative Perspectives on Trade and Development,' in Chenery ed., *Handbook of Development Economics*, North Holland, 1989.
- [ 3 ] Hanasaki, K., 'Arugiri Emmanuel Futouka Koukann—Kokkakan no Keizaiteki Shokannkei ni okeru Shotekitai Kannkei ni tsuiteno Shironn (Preliminary Thesis on Various Conflicts Among Nations),' in *Shinteikokushugi Ronn-*

- sou (Debates on New Imperialism)*, Akishobou, 1973.
- [ 4 ] Izumi, H., 'Estimation of the Surplus Value Rates Using Labor Values', *Keizai* 193, 1980.
- [ 5 ] Izumi, H., 'International Comparison of the Rate of Surplus Value Using Labor Values,' *Keizai*, 227, 1983.
- [ 6 ] Izumi, H., 'Sanngyou Rennkann-hyou niyoru Roudouseisannsei, Jouyo-kachi-ritsu no Kokusai Hikaku—Nihonn Amerika Kannkoku ni kannsuru Shisann (International Comparison of Labour Productivity and Rate of Surplus Value by Input Output Tables—Case of Japan U.S.A. and Korea)' in *Gendai no Kaikyuu Kousei to Shotoku Bumpai (Present Day Class Structure and Income Distribution)*, Yuuhikaku, 1984.
- [ 7 ] Izumi, H., 'A Survey of Estimations of the Rate of Surplus Value in Japan' (mimeographed) 1985.
- [ 8 ] Izumi, H., *Jouyo-kachi-ritsu no Jissho Kenkyu (Empirical Study of Rate of Surplus Value)* Horitsu Bunka Sha, 1992.
- [10] Izumi, H., 'Jouyo-kachi-ritsu (Rate of Surplus Value)' in *Roudou Toukei no Kokusai Hikaku (International Comparison of Labor Statistics)*, Azusa Shuppan Sha, 1993.
- [11] Izumi, H., and Nakajima, A., 'Kokusaiteki Futou Roudouryou Koukan no Keisoku ni tsuite,' (On Measuring International Unequal Exchange of Labor ) in *Keizai Toukeigaku no Gendaika*, Kōyō Shobou, 1995.
- [12] Kinoshita, E. ed., *Ronsou: Kokusai Kachiron (Debates on International Value Theory)*, Koubunndou, 1960.
- [13] Nakajima, A., 'Toukaroudouryou. Shotokuritsu to Keizai Hatten (Total Labour Inputs, Value Added per Labour and Economic Development)', *Kyoto Daigaku Keizai Ronsou (Kyoto University Economic Review)*, Vol. 150, No. 4, 1992.
- [14] Nakajima, A., 'Exploitation, Unequal Exchange and Economic Development,' in *Proceedings of the International Congress on Modelling and Simulation*, Vol. 3, pp. 1313–1318, 1993.
- [15] Nakajima, A., 'Unequal Exchange, Exploitation and Economic Development: Interrelationship of value added per labour and total labour inputs,' *Working paper*, no. 23, Faculty of Economics, Kyoto University, 1994.
- [16] Nakajima, A., 'Labor Theory of Value and Cobb-Douglas Production Function in Terms of Value Added per Direct Labor and Total Labor Inputs,' *Working Paper*, Faculty of Economics Kyoto University, No. 24, 1994.
- [17] Nakajima, A., 'Futouka koukann, sakushu to Keizai Hatten' Unequal Exchange, Exploitation and Economic Development', *Working Paper*, No. J-2, Faculty of Economics, Kyoto University, 1994.
- [18] Nakajima, A., and Izumi, H., 'Economic Development and Unequal Exchange among Nations: Analysis of the U.S., Japan and South Korea' in *Review of Radical Political Economics*, Vol. 27, No. 3, 1995.
- [19] Okishio, N., *Marukusu Keizaigaku (Marxian Economics)*, Chikuma-shobo, 1977.
- [20] Okishio, N., 'Roudou Kachisetsu no Shuyou Meidai (On Labour Theory of

Value)', *Kobe University Keizaigaku Kenkyuu Nennpou (Kobe University Annual Report of Economics Research)*, No. 36, 1989.

- [21] Shaikh, A.M. and Tonak, E.A, *Measuring the Wealth of Nations, the Political Economy of National Accounts*, Cambridge University Press, 1994.
- [22] Wolff, E.N., *Growth, Accumulation and Unproductive Activity*, Cambridge University Press, 1987.

## DATA SOURCES:

## 1. Input-Output tables

⟨Japan⟩ Government of Japan:

“1960–1965 Link Input-Output Tables”

“1970 Input-Output Tables”

“1975 Input-Output Tables”

“1980 Input-Output Tables”

“1985 Input-Output Tables”

⟨U.S.A.⟩

‘The Transactions Table of the 1958 Input-Output Study and Revised Direct and Total Requirements Data’ “Survey of Current Business” September 1965

‘Input-Output Transactions: 1961’ U.S. Department of Commerce “Staff Working Paper in Economic and Statistics, No. 16”

From above two tables, we made 1960 U.S.A. Input-Output table.  $A^{1960} = (A^{1958} + A^{1961} \times 2) / 3$

‘Input-Output Structure of the U.S. Economy: 1963’ “Survey of Current Business” November 1969

‘Input-Output Structure of the U.S. Economy: 1967’ “Survey of Current Business” November 1969

From above two tables, we made 1965 U.S.A. Input-Output table.  $A^{1965} = (A^{1963} + A^{1967} \times 2) / 2$

‘International Input-Output Table Japan-U.S.A. 1970’ Institute of Developing Economies, Tokyo, Japan

From above table, we took out 1970 U.S.A. Input-Output table.

‘Summary Input-Output Tables of the U.S. Economy: 1973, 1974, and 1975’ U.S. Department of Commerce BEA “Staff Paper No. 37”

‘1980 Input-Output Data’ BEA IED 87-406 (Diskette)

‘Annual Input-Output Accounts of the U.S. Economy, 1985’ “Survey of Current Business” January 1990

⟨Republic of Korea⟩ The Bank of Korea

“1960 Input-Output Tables”

“1963 Input-Output Tables”

“1966 Input-Output Tables”

From above two tables, we made 1965 R.O.K. Input-Output table.  $A^{1965} = (A^{1963} + A^{1966} \times 2) / 3$

“1970 Input-Output Tables”

“1975 Input-Output Tables”

“1980 Input-Output Tables”

“1985 Input-Output Tables”

## 2. Employed Persons by Industry

⟨Japan and Republic of Korea⟩

“Tables on Persons Engaged in Production Activities” in the supporting tables of the above Input-Output Tables

⟨U.S.A.⟩

“Time Series Data for Input-Output Industries” U.S. Department of Labor

## 3. Average Hours Worked per Worker by Industry

⟨Japan and Republic of Korea⟩

“Labor Force Survey”

⟨U.S.A.⟩

“Time Series Data for Input-Output Industries” U.S. Department of Labor

## 4. Capital Consumption Data

⟨Japan⟩

Above Input-Output Tables

“Tables on Fixed capital Formation” in the supporting tables of the above 1970, 1975, 1980, 1985 Input-Output Tables

⟨Republic of Korea⟩

The above Input-Output Tables

⟨U.S.A.⟩

“Fixed Reproducible Tangible Wealth in the United States 1925–85” U.S. Department of Commerce

‘Interindustry Transactions in New Structures and Equipment, 1963’ “Survey of Current Business” August 1971

‘Interindustry Transactions in New Structures and Equipment, 1967’ “Survey of Current Business”



September 1975

'Interindustry Transactions in New Structures and Equipment, 1972' "Survey of Current Business"  
July 1980

'Interindustry Transactions in New Structures and Equipment, 1977' "Survey of Current Business"  
August 1985

5. Commodity Trade Statistics

"Commodity Trade Statistics" United Nations (SITC Rev. 1)

"1960 Annual Return of the Foreign Trade of Japan" Japan Tariff Association

"External Trade Statistics for 1960" The Bank of Korea

6. Exchange Rates

"Yearbook" International Monetary Fund