Production and Outsourcing in Japanese Economy

Toshiaki Hasegawa

Faculty of Economics

CHUO University, Tokyo, JAPAN

vinomac@tamacc.chuo-u.ac.jp

Introduction

Globalization has been carried out through the selective decision from a variety of options in the business companies' activities. The decision for the business company is made from the four alternatives. In **World Trade Report 2008** by WTO (2008), such activities were summarized in the following Table 1. "Offshoring" in this selective activity by the business company was defined to be measured in the context of input-output tables in OECD (2007 and 2008) and WTO (2008), in which the offshoring was focused on labor inputs.[1] Quoted from E. Helpman's definition of "outsourcing" as the "acquisition of an input or a service from an unaffiliated company" (Helpman, 2006)[2], WTO (2008) restated "offshoring" as "the sourcing of input goods or services from a foreign country. This includes sourcing from a foreign affiliate through foreign direct investment (FDI) and sourcing from a foreign non-affiliate through arm's length contracts. While FDI involves intra-firm trade, arm's-length offshoring involves trade between firms." This paper focuses on the two index of offshoring.

Table 1 Source of input goods or services

		Outsourcing
	affiliate	non-affiliate
at home	domestic production within the firm	domestic outsourcing
offshoring abroad	FDI intra-firm trade	international outsourcing arm's length trade

Source: WTO, *World Trade Report 2008 – Trade in a Globalizing World*, 2008, p.99.

The importance of intermediate goods in industrial activity

The data come from JIDEA VAM Bank 1985-2006 and the OECD's Input-Output Database: 2006

---

[1] OECD, "Offshoring and Employment: Trends and Impacts", OECD, Paris. 2007, K. D. Backer and N. Yamano, "The measurement of Globalization using International Input-Output Tables", in OECD, Staying Competitive in the Global Economy – Compendium of Studies on Global Value Chains, OECD, 2008 and WTO, *World Trade Report 2008 – Trade in a Globalizing World*, 2008.

[2] E. Helpman, (2006) 'Trade, FDI, and the organization of firms', *Journal of Economic Literature* 44, 3: 589-630.

Edition (Yamano and Ahmad, 2006). The OECD database contains 48 standardized industry input-output tables (using the third revision of the International Standardized Industrial Classification) based on data for the year 2000. Out of these 48 industries, 22 were classified as manufacturing (from manufacturing food products and beverages to recycling) in OECD (2008).[3]

In the current JIDEA model, the shares of intermediate inputs in total output by the j-th industry sector among 66 industries are shown for the selected industries.[4] Figure shows that the sector 42 of Semiconductor devices & integrated circuits has drastically dropped down. The likely cause might be the price fall due to the unremitting generation change in product by technology progress.

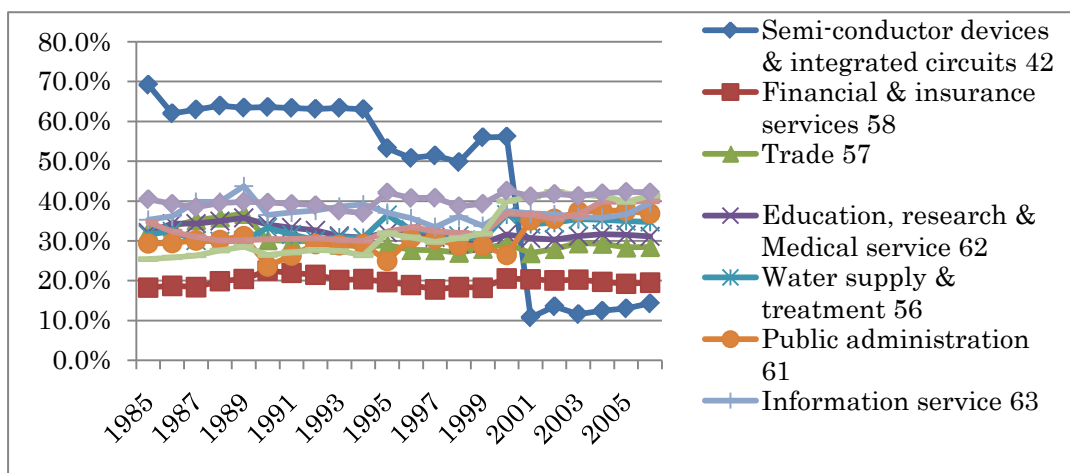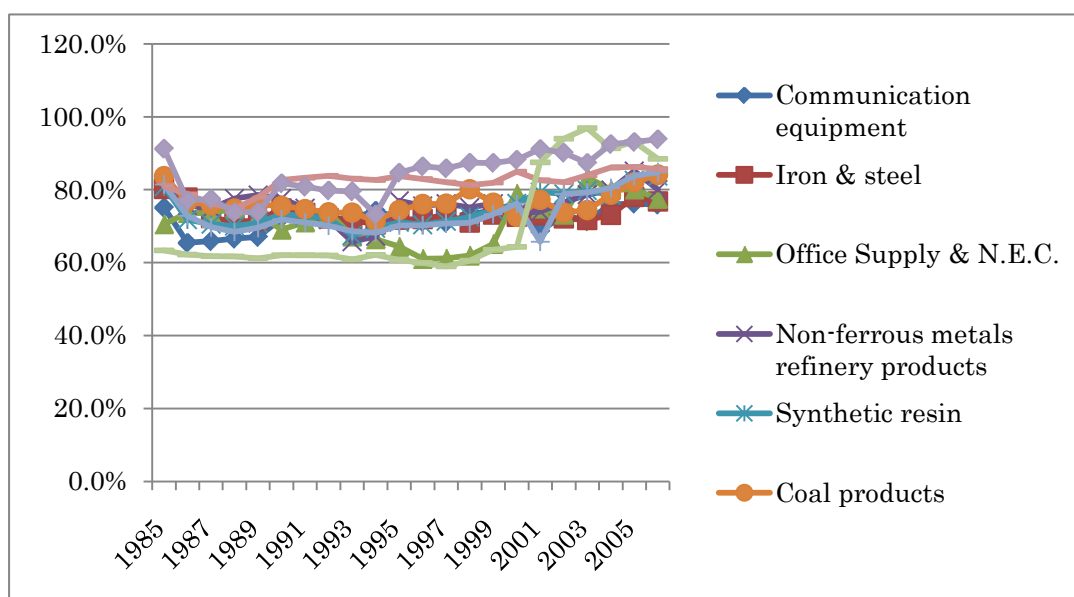**Figure 1 Lowest 10 Industries of Ratio of Intermediate Input to Output**

Figure 2 Highest 10 Industries of Ratio of Intermediate Input to Output

In order to discriminate the input goods and/or services imported from the input goods and/or services domestically produced, it is necessary for us to prepare the non-competitive type input-output table. Simplified non-competitive type of Japanese input-output table consolidated from OECD database is shown in Table 2. Offshoring of the j-th industry is measured as the share of foreign inputs i in all non-energy inputs i used by sector j. The index indicates that the more inputs imported by a sector, the higher the index for the sector.

$$OI_j = \sum_i x_m^{ij} / \left[\sum_i x_d^{ij} + \sum_i x_m^{ij} \right]$$

Table 2

Simplified OECD Input-Output Table for Japanese Economy in 2000 unit: Millions of Japanese Yen

A (=B+C) Total table

	Primary industry	Mfg industry	Tertiary industry	Total intermediate	Dom final demand	Export	Total demand	(less) Import	Total output
Primary industry	1,614,416	7,695,211	2,230,531	11,540,158	1,424,985	97,543	25,273,747	9,671,692	15,602,055
Manufacturing industry	2,509,100	117,051,398	64,219,037	183,779,535	37,565,047	45,306,296	320,517,047	31,556,814	288,960,233
Tertiary industry	2,604,538	61,606,202	166,732,272	230,943,012	177,024,417	10,933,524	638,177,147	9,096,735	629,080,412
Intermediate consumption /final use	6,728,053	186,352,812	233,181,840	426,262,705	216,014,449	56,337,363	983,967,941	50,325,241	933,642,700

B Domestic Intermediate Input

	Primary industry	Mfg industry	Tertiary industry	Total intermediate
Primary industry	1,492,872	6,382,402	2,011,324	9,886,598
Manufacturing industry	2,344,107	104,268,696	60,312,706	166,925,509
Tertiary industry	2,586,869	60,918,368	162,414,178	225,919,415
Intermediate consumption /final use	6,423,848	171,569,465	224,738,208	402,731,522

C Imported Intermediate Input

	Primary industry	Mfg industry	Tertiary industry	Total intermediate
Primary industry	121,544	1,312,810	219,206	1,653,560
Manufacturing industry	164,993	12,782,702	3,906,331	16,854,026
Tertiary industry	17,668	687,834	4,318,095	5,023,597
Intermediate consumption /final use	304,205	14,783,346	8,443,632	23,531,183

Source: The above tables were calculated by T. Hasegawa using OECD Input-Output Table (OECD, 2006).

In this consolidated input-output table, the import penetration ratio, the export ratio, and the offshoring index (OI) for whole Japanese economy in 2000 are obtained as follows;

Import penetration ratio = Import / Total demand = 5.11%

Export ratio = Export / Total output = 6.03%

Offshoring Index =OI $= \dfrac{\text{Sum of Total Imported Intermediate Inputs}}{\text{Sum of Total Intermediate Inputs in Total Table}} = \mathbf{5.52\%}$.

Figure 3 Japanese Offshoring Index by Industry in 2005
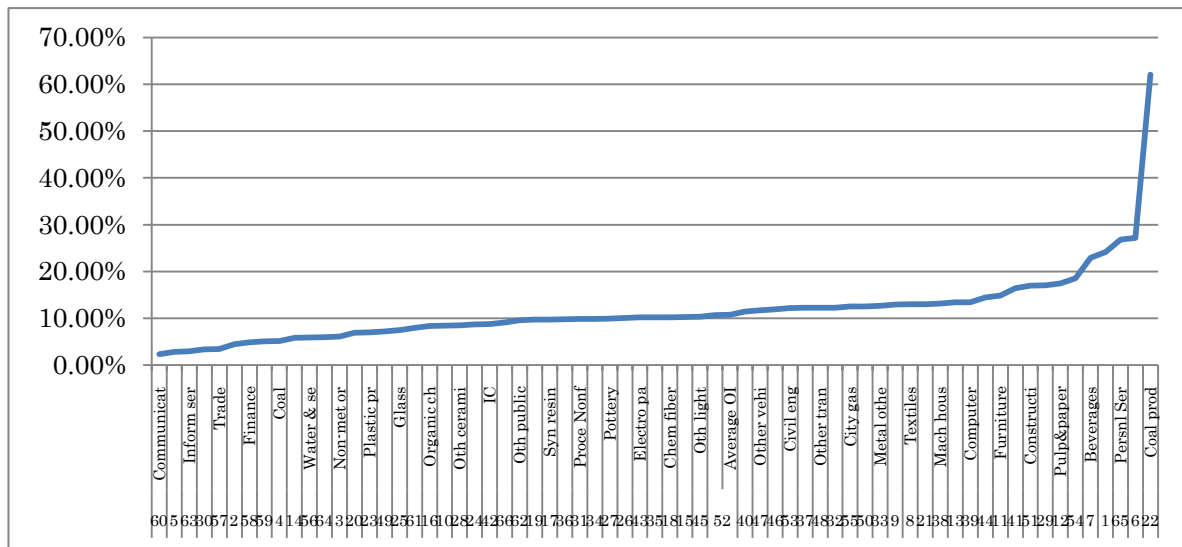
Top 5 Japanese industries of Offshoring Index(OI_j) in 2005, which shows the index level over 20.0%, are sector 22 Coal product 62.03%, 6 Food products 27.18%, 65 Personal Service 26.84%, 1 Agriculture, fishery & forestry 24.13%, and 7 Beverages 22.95%. Average OI is 10.78%.

Alternative measure of offshoring is to compare with the vertical specialization. D. Hummels (Hummels et al., 2001)[5] introduced the index of vertical specialization to explain only for manufacturing products. This index is to calculate the foreign content of countries exports.

$$VS_i = u * A_m * (I - A_d)^{-1} * X/X_k$$

where u denotes 1xn vector, A_m and A_d are the nxn imported intermediate input coefficient and domestic intermediate input coefficient matrix. And, X is the nx1 export vector, where X is normalized by total country export , X_k. WTO[6] calculated the vertical specialization index to compare with countries each other. According to this calculation, Japanese rank of vertical specialization is seated at the lowest position in 1995 and 2005. Japanese index of vertical specialization had grown 9.5% in 1995 to 14.0% in 2000. This growing tendency was observed almost for the other all countries.

In the following Table 3, we can compare the vertical specialization index with the domestication raio, which is defined as the formula, $rhoj = \frac{\sum_i A_d^{ij} + V_j}{X_j}$.

[5] Hummels, D., J. Ishii and K. Yi, "The Nature and Growth of Vertical Specialization in World Trade", Journal of International Economics, Vol. 54, pp. 75-96.

[6] WTO, World Trade Report 2008, 2008, p.104.

Table 3 Domestication and Offshoring in Japanese Economy

		Domestication ratio				Offshoring Index
		rho85	rho95	rho05		OI
1	Agri,fishe	0.931	0.965	0.885		24.13%
2	Metalic or	0.964	0.984	0.976		4.44%
3	Non-met or	0.975	0.977	0.964		6.14%
4	Coal	0.963	0.985	0.968		5.17%
5	Petro & ga	0.994	0.992	0.989		2.84%
6	Food prod	0.979	0.935	0.822		27.18%
7	Beverages	1.005	0.971	0.896		22.95%
8	Textiles	0.983	0.952	0.912		13.01%
9	Clothing	1.001	0.947	0.926		12.94%
10	Wood	0.968	0.925	0.949		8.46%
11	Furniture	0.981	0.949	0.910		14.83%
12	Pulp&paper	0.981	0.965	0.887		17.48%
13	Printing	0.985	0.984	0.936		13.39%
14	Inorg chem	0.984	0.948	0.958		5.84%
15	Petro chem	0.988	0.917	0.908		10.31%
16	Organic ch	0.996	0.944	0.931		8.39%
17	Syn resin	1.002	0.931	0.920		9.75%
18	Chem fiber	0.997	0.946	0.934		10.22%
19	Final chem	0.982	0.957	0.932		9.74%
20	Medicine	0.992	0.977	0.954		6.91%
21	Petro prod	0.978	0.661	0.924		13.03%
22	Coal prod	1.003	0.710	0.515		62.03%
23	Plastic pr	0.987	0.974	0.959		7.01%
24	Rubber pro	0.965	0.952	0.946		8.68%
25	Glass	0.974	0.970	0.960		7.45%
26	Cement	0.979	0.964	0.939		10.10%
27	Pottery	0.983	0.970	0.940		9.94%
28	Oth cerami	0.988	0.965	0.953		8.51%
29	Iron & ste	0.998	0.958	0.875		17.05%
30	Nonfer met	0.983	0.612	0.975		3.35%
31	Proce Nonf	0.951	0.786	0.932		9.84%
32	Metal cons	0.964	0.980	0.917		12.28%
33	Metal othe	0.958	0.981	0.935		12.65%
34	Machine ge	0.961	0.972	0.939		9.89%
35	Machine sp	0.973	0.971	0.937		10.20%
36	Machine ot	0.948	0.981	0.946		9.78%
37	Mach offic	0.993	0.953	0.911		12.25%
38	Mach hous	0.987	0.953	0.917		13.15%
39	Computer	0.975	0.894	0.900		13.43%
40	Communic e	0.969	0.950	0.918		11.42%
41	El apld&me	0.979	0.942	0.881		16.44%
42	IC	0.988	0.972	0.943		8.78%
43	Electro pa	0.986	0.968	0.928		10.20%
44	Heavy elec	0.973	0.966	0.905		14.44%
45	Oth light	0.979	0.949	0.926		10.37%
46	Motor vehi	0.970	0.981	0.902		11.95%
47	Other vehi	0.977	0.980	0.914		11.73%
48	Other tran	0.962	0.961	0.914		12.27%
49	Precision	0.997	0.943	0.960		7.22%
50	Mfg miscel	1.000	0.936	0.914		12.55%
51	Constructi	0.998	0.972	0.912		16.95%
52	Civil eng	0.938	0.982	0.945		10.69%
53	Civil eng	0.988	0.980	0.938		12.22%
54	Elec power	0.985	0.927	0.899		18.56%
55	City gas	1.023	0.873	0.929		12.52%
56	Water & se	0.984	0.990	0.980		5.93%
57	Trade	0.984	0.991	0.990		3.41%
58	Finance	0.977	0.996	0.991		4.87%
59	Transport	0.980	0.982	0.979		5.06%
60	Communicat	0.956	0.990	0.990		2.36%
61	Government	0.986	0.986	0.971		7.97%
62	Oth public	0.969	0.985	0.970		9.60%
63	Inform ser	0.977	0.989	0.988		2.97%
64	Buisnes se	0.978	0.986	0.974		5.97%
65	Persnl Ser	1.005	0.976	0.890		26.84%
66	Office sup	0.974	4.029	0.928		9.11%
intcoltot	Total Average	0.980	0.996	0.950		10.78%

Hummels et al. (2001) find that growth in vertical specialization accounted for more than 30 per cent of export growth in most of the OECD countries in the 1970s and 1980s.

Hummels et al. pointed out some problems with the measurement affected by the level of sectoral aggregation of data, and with neglecting the fact that a country's export is utilized as intermediate input by the imported country.

Recent literatures of international economics have come close to the approaches taken by economic geography. Also, the analyses have introduced the micro data to inspect the behaviors of multinational business companies. By extension of these researches, two alternative offshoring index based on the input-output tables have been developed. It seems to us that the input-output analysis based on the dynamic framework might be useful in the further analysis to forecast the macro-economic impact of the business companies' offshoring. Another problem is to analyze what kind of factors could affect on the level of offshoring. Regarding to this problem, many literatures in economic geography have been contributed to stress on trade cost such as tariff barriers, transportation cost, communication cost and so on.[7]

---

[7] World Bank (2009), World Development Report 2009 ---Reshaping Economic Geography, Hummels, David, (2007), "Transportation Costs and International Trade in the Second Era of Globalization." Journal of Economic Perspectives, Vol. 21, No. 3, Summer 2007: 131–154. Brooks, D. H. and David Hummels, (eds.), Infrastructure's Role in Lowering Asia's Trade Costs – Building for Trade -, Edward Elgar, 2009.