# The reconsideration of Japanese comparative advantage

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Since the collapse of Lehman Brothers in 2008, the center of the world economy has been increasingly shifting from developed countries to developing countries with a growing domestic demand. The environment surrounding the Japanese export-driven economy has been more and more severe against the backdrop of the trend toward lower-priced goods in developing countries and strong yen. As a result, many people now point out the decline in competitiveness of Japanese manufacturing.

In this harsh economy situation, many policy options have been proposed such as a corporate tax cut or an acceleration of free-trade practices represented by FTA or TPP. Certainly, these cross-industry approaches can be directly effective in putting Japan on an equal footing with other rival countries. However, this essay is going to take industry-specific approach based on trade theories..

Trade theories is a foothold toward a comprehensive understanding of international location of industries, and therefore, Ricardo model, Heckscher-Ohlin model, and other intra-industry and gravity model can be helpful in that point.

Ricardo model, which claims that the pattern of trade between countries is determined by comparative advantage where each country exports goods for which the labor productivity is relatively high and imports goods for which the labor productivity is relatively low. According to Krugman(2008), the empirical test result has not necessarily been what the theory predicts. One of the main reasons he cited is less opportunities to check which countries have relatively high productivity in which industry with the expansion of world trade and the increasing specialization of each country's economy. Nevertheless, he stated that the theory can be considered positively effective from the comparison of Germany and China: While the overall productivity for China was just 5% of that for Germany and the overall production was less than 30% below Germany level, the productivity for the Chinese apparel industry was one-fifth of Gernany level and the production level was about eight times that in Germany. From this clear example, we can say that Ricardo model works in a real situation to some extent.

Heckscher-Ohlin model, which presents that a country will export goods that use its abundant factor intensively and import the other good, is also not necessarily supported from past data. Leontief(1953), for example, obtained the seemingly contradictable result that American exports have lower capital-labor ratio than its imports and this result has been called "The Leontief Paradox". Another example was from Bowen(1987), which demonstrated that real trade was not what Heckscher-Ohlin model predicts comparing the proportion of each

country’s endowment of production element and the rate of its income. However, it does not mean that Heckscher-Ohlin model does not work entirely. As discussed in the context of The Leontief Paradox, the United States tend to export goods that use technology intensively and that is consistent with the actual situation. Moreover, Romalis(2004) showed that the share of Bangladesh for clothes in the imports of the United States had been high, which is consistent with the theory. Overall, it can be said that Heckscher-Ohlin model explains the real trade patternto some extent.

These two theories above written are partly effective in their explanation of the real trade. However, in reality, the notion of intra-industry trade had been proposed given the fact that these traditional theories had not been able to explain the major part of global trade. Actually, METI(2006) has demonstrated the increasing share of intra-industry trade in the case of Japan in the 1990’s. Nevertheless, as is demonstrated in some thesis, intra-industry trade can occur with inter-industry trade on the assumption of goods differentiation.

A comprehensive survey of trade theories leads to the conclusion that Ricardo model and Heckscher-Ohlin model are on the whole useful in understanding real trade pattern while we have to take intra-industry trade into account. Therefore, this essay is going to make empirical analysis on the two models using Japanese trade data.

○Ricardo model

(1)Framework

In the Ricardo model, comparative advantage is defined by ranking domestic and foreign labor productivities by sector. Let a represent factor use per unit of output, defining it either for labor alone or in relation to labor and capital,

$$a = \frac{L}{Q}$$

$$a = \frac{L^{\alpha} K^{1-\alpha}}{Q}$$

where Q is value added, L is labor employment, K is capital stock, and α is labor’s share of income. Using either measure of factor input, we can obtain a chain of comparative advantage, in order of diminishing home country comparative advantage, where * denotes the foreign

country and n is the number of commodities:

$$a_1^*/a_1 \succ a_2^*/a_2 \succ a_3^*/a_3 \succ \cdots \succ a_i^*/a_i \cdots \succ a_n^*/a_n$$

The key question is which goods are produced at home and which abroad. Where the chain of comparative advantage is broken also depends on relative wages(w) and the exchange rate(e), which determine unit labor cost, denoted by $C_{i,}$ in a common currency.

$$C_i = e \times w_i^* \times a_i^* / w_i \times a_i$$

According to the Ricardian model, the home country will produce and export those goods where $C_i$ is greater than unity and import those goods where $C_i$ is less than unity.

A few points about $C_i$ should be noted. First, unlike in most versions of the Ricardian model, this essay allows for sectoral wage disparities to account for differences in education between sectors and imperfections in the labor market. Comparative advantage, therefore, may reflect wage differences as well as productivity differences across sectors and countries. Second, unit labor cost may be an imperfect gauge of competitiveness if quality differences are not measured accurately or if labor is not the only factor of production. Quality differences between foreign and domestic products might imply that the critical value of $C_i$ is different from 1.

(2)Data

Most of the data for this study were taken from the OECD, which contains consistent trade, value-added, labor compensation data for major OECD countries(Japan, United States, Germany, Canada, France, Italy, United Kingdom, Korea) disaggregated into 13 sectors. The data is from 1992 to 2005.

(3)Statistical analysis of Intra G-7 Sectoral Trade Balances(Time-series regressions)

Net exports relative to sectoral value added are regressed on relative unit labor cost(domestic relative to total G-7 GDP) and other variables. All variables are in logarithms except for the trade balance. Letting i represent the country and j the sector, $TB^{ij}$ is the sectoral trade balance(intra G-7) divided by sectoral GDP, $C^{ij}$ is the log of unit labor cost, $Y^i$ is the log of

country i's total GDP divided by total G7 GDP, and T is a year dummy variable. The individual sectoral equations are specified as

$$TB^{ij} = a + b_1 C^{ij} + b_2 C^{ij}{}_{-1} + b_3 C^{ij}{}_{-2} + b_4 C^{ij}{}_{-3} + b_5 Y^{i} + b_6 T$$

The result is shown in table 1, which indicates the coefficient of relative unit labor cost for each country. This table illustrates that while the coefficients of the United States or France are negative, those of Japan or Canada are positive, indicating export in those countries increases with the rising unit labor cost compared to G-7. From this result, Ricardo model is not supported in the case of Japan.

○Heckscher-Ohlin model

(1)Framework

In the Heckscher-Ohlin model, it is proposed that a country will export the good that uses its abundant factor intensively and import the other good. Firstly, we test the applicability of this theory using Leontief(1953) approach. His approach measures the amounts of labor and capital used in all industries needed to produce export goods and import goods using I-O table and compares the capital-labor ratio for exports and imports. His theory predicts that the capital-labor ratio for exports are higher than that for imports if the country is more abundant with capital and vice versa.

ⅰ） $Kx/Lx \succ Km/Lm$ (in case for a capital-abundant country)

ⅱ） $Kx/Lx \prec Km/Lm$ (in case for a labor-abundant country)

However, Leamer(1980) pointed out that whether export is more labor-intensive than import can not be decided in case for a labor-abundant country if the amount of both capital and labor used for export are larger than that for import when we exclude the precondition of equality in trade balance. He asserted that the propositions made by Leontief are only effective on the assumption of equality in trade balance and proposed that one of the following conditions holds in a capital-abundant country, where $Kt, Lt, \quad Ki, Li, Kc, Lc$ are capital and labor embodied in net exports, endowment, consumption:

（1） $Kt > 0, Lt > 0, Kt/Lt > Ki/Li > Kc/Lc$

（2） $Kt > 0, Lt < 0, Ki/Li > Kc/Lc > Kt/Lt$

（3） $Kt < 0, Lt < 0, Ki/Li > Kc/Lc > Kt/Lt$

In the Leontief and Leamer propositions above, it is possible to look at the overall capital-labor ratio a country has, and secondly, we checked the relation between capital-labor ratio and comparative advantage in every major product.

(2)Data

All the data for this study were taken from the JIP 2010 database made by research institute of Economy, Trade, and Industry. We took the number of employees as labor input and the nominal capital service as capital input. Moreover, we calculated capital and labor used directly as well as indirectly using an inverse matrix of I-O table.

(3)Result

The result is shown in table2. Capital-labor ratios for net export, endowment, and consumption are 3.4, 2.1,2.0(units are million yen per employee) respectively and it is confirmed that Japan, which is capital-abundant country, meet the condition of (1) in Leamer proposition. Furthermore, looking at the relation between capital-labor ratio and comparative advantage, we found that goods with higher capital-labor ratio tend to have higher net export ratio to GDP(table 3).

These empirical analysis results about Ricardo and Heckscher-Ohlin model indicated that Japan tends to export products with higher capital-labor ratio.

Next, we compare the extent of comparative advantage of Japan with a country that has similar endowment of production element given the applicability of the Heckscher-Ohlin model because it makes us expect that there is almost the same level of comparative advantage for every product between countries with similar endowments.

In this point, the index for measurement and the country to compare with should be carefully selected when we compare the extent of comparative advantage with other countries.

Trade Specialization Coefficient, which denotes net export to overall trade values, has usually been main focus in discussions on comparative advantage. In reality, the index can be said to show their comparative advantage to some extent in that it compares the amount of export and import for each product and it has the advantage of comparability among products as it is respectively divided by its overall trade value.

However, it has some notes to recognize. Firstly, we can not conclude that trade specialization coefficient above zero for a good does not necessarily mean that the country has comparative advantage in the good. For example, although the index for automobiles and steel are above zero in Japan and below zero in America, it does not necessarily mean that Japan has comparative advantage in automobiles and steel because it can reflect the oversaving of Japan and the overconsumption of America. More substantial problem is that this index is likely to be influenced by the regulation toward imports as is pointed out in Balassa(1963) , so it is inappropriate to use this index to measure the comparative advantage in this context. From this point, we employ RCA index, which is considered less likely to be affected by import regulation.

To select the country to compare with, we made comparison about the endowment of production elements such as labor, land and capital among major countries, finding that every country has different pattern in resource endowment(graph 4). For China, the labor ratio is larger than GDP proportion and in India or Indonesia there exists more labor and land. On the other hand, Australia, America and Germany show different patterns. Australia is relatively abundant in land. The proportion of the three elements- labor, land and capital- are below the level of the GDP ratio in the United States, which can be considered to reflect the possibility of the country making use of the its resource effectively. Looking at Germany, we can find that Germany is relatively abundant in capital compared with labor or land and similar to Japan. To sum up, Germany is an appropriate to compare with Japan in the extent of comparative advantage.

From the ratio for RCA index between Japan and Germany by major products, while the indexes for steel as well as electronic appliances of Japan are relatively higher, those for metal and chemical products of Japan are relatively smaller except foods and beverages, which are considered much likely to be affected by elements such as climate or soil. (table 5)

A closer look at steel products shows that those of other alloy steel and other flat-rolled products are relatively higher while in the electronic appliances video recoding and reproduction apparatus, semiconductors etc and parts of audio, visual apparatus have higher ratio. (table 6,7)

On the other hand, looking at the chemical products with smaller RCA index, we can find that the index for medical products and fertilizers are extremely low and that for cosmetics are relatively small. (table 8) For the metal products, structural parts and metal containers have relatively low index. (table 9) Moreover, in the machinery, while parts of computers and

semiconductor machinery are relatively higher, the index for printing machines and food-processing machines are comparatively low. (table 10) Transport equipment shows that although ships and cycles with engines have relatively large index, aircrafts are noticeably low. From this result, we found that Japan has relatively lower RCA index in metal and chemical products, machinery and transport equipment and especially the index for products such as medical products and aircrafts are extremely low.

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Table 1. The empirical test result of Ricardo model

| | b1(coefficient) | t-value |
|---|---|---|
| Japan | 0.23 | 2.74 |
| United States | -0.13 | -1.54 |
| Germany | 0.10 | 1.02 |
| Canada | 2.29 | 3.72 |
| France | -0.03 | -0.17 |
| Italy | -0.11 | -0.55 |
| United Kingdom | 0.54 | 2.06 |
| Korea | 0.85 | 2.23 |

Sources: Author's calculations

Table 2. The empirical test result of Heckscher-Ohlin model

(1)Leontief's test

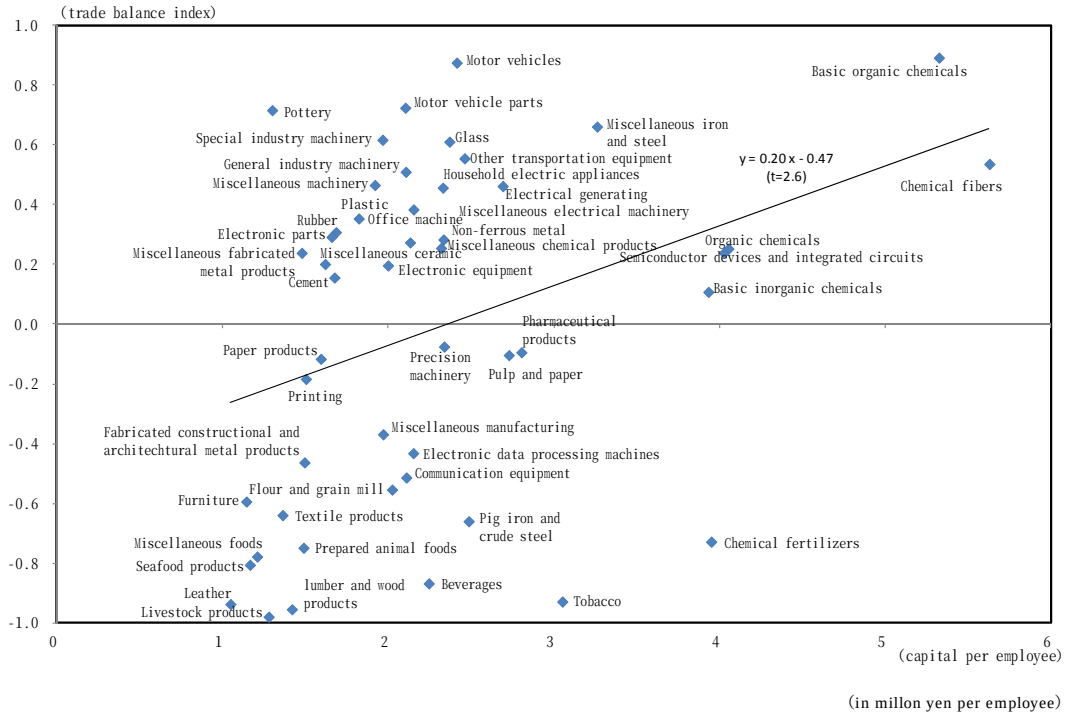
| (Km/Lm)/(Kx/Lx) |
|---|
| 0.8 |

(2)Leamer's test ( unit: in millions yen per employee )

| Km/Lm | Kx/Lx | Kt/Lt | Ki/Li | Kc/Lc |
|---|---|---|---|---|
| 2.0 | 2.4 | 3.4 | 2.1 | 2.0 |

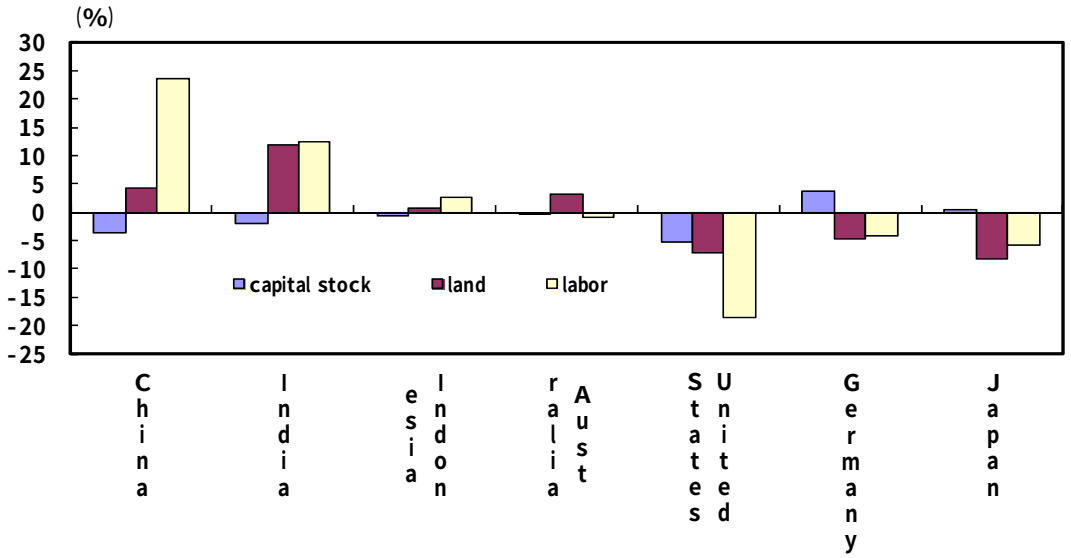
Sources: Author's calculations

Graph 3. The relation between trade balance index and capital-labor ratio




Sources: RIETI's JIP 2010 Database

Graph 4. The proportion of capital stock, land and labor in the world among major countries




Notes: 1.Author's calculations

2.Each country's baseline is set at the country's GDP proportion of the world.

Table 5. The ratio of Japanese RCA index to the Germany RCA index by major items

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOODSTUFF | 0.11 | 0.11 | 0.11 | 0.11 | 0.17 | 0.12 | 0.12 | 0.12 | 0.11 | 0.11 | 0.12 | 0.11 |
| RAW MATERIALS | 0.41 | 0.48 | 0.47 | 0.46 | 0.57 | 0.57 | 0.66 | 0.72 | 0.73 | 0.69 | 0.70 | 0.74 |
| MINERAL FUELS | 0.39 | 0.31 | 0.28 | 0.22 | 0.26 | 0.24 | 0.22 | 0.22 | 0.35 | 0.36 | 0.57 | 0.94 |
| CHEMICALS | 0.54 | 0.55 | 0.57 | 0.58 | 0.58 | 0.62 | 0.64 | 0.62 | 0.61 | 0.60 | 0.62 | 0.57 |
| IRON AND STEEL PRODUCTS | 1.42 | 1.46 | 1.51 | 1.47 | 1.56 | 1.78 | 1.91 | 1.83 | 1.81 | 1.70 | 1.69 | 2.02 |
| NONFERROUS METALS | 0.72 | 0.85 | 0.82 | 0.67 | 0.79 | 0.82 | 0.84 | 0.75 | 0.75 | 0.83 | 0.99 | 1.08 |
| NON-METALLIC MINERAL WARE | 0.83 | 0.72 | 0.74 | 0.88 | 0.88 | 0.86 | 0.92 | 0.98 | 1.08 | 1.04 | 1.02 | 1.08 |
| MANUFACTURES OF METALS | 0.64 | 0.56 | 0.57 | 0.57 | 0.60 | 0.58 | 0.60 | 0.60 | 0.55 | 0.52 | 0.50 | 0.51 |
| MACHINERY | 1.36 | 1.29 | 1.22 | 1.19 | 1.17 | 1.17 | 1.17 | 1.11 | 1.07 | 1.05 | 1.20 | 1.21 |
| ELECTRICAL MACHINERY | 2.11 | 2.06 | 2.14 | 2.19 | 1.93 | 1.92 | 2.00 | 2.01 | 1.92 | 1.92 | 1.91 | 1.89 |
| TRANSPORT EQUIPMENT | 1.24 | 1.23 | 1.15 | 1.10 | 1.10 | 1.17 | 1.18 | 1.21 | 1.20 | 1.30 | 1.35 | 1.39 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 6. The ratio of Japanese RCA index to the Germany RCA index by various iron and steel products

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Those of stainless steel | 1.03 | 1.07 | 1.05 | 1.02 | 1.12 | 1.48 | 1.60 | 1.42 | 1.38 | 1.39 | 1.43 | 1.89 |
| Other flat-rolled products | 1.54 | 1.58 | 1.88 | 1.96 | 2.05 | 2.56 | 2.82 | 2.83 | 2.90 | 2.50 | 2.41 | 3.14 |
| Clad, plated or coated | 1.51 | 1.51 | 1.61 | 1.55 | 1.51 | 1.58 | 1.63 | 1.64 | 1.77 | 1.50 | 1.61 | 2.02 |
| Railes&railway materials | 2.07 | 2.01 | 1.38 | 1.62 | 1.07 | 0.93 | 1.19 | 1.16 | 1.02 | 1.38 | 1.47 | 1.48 |
| Tubes and pipes | 1.26 | 1.31 | 1.23 | 1.02 | 1.49 | 1.43 | 1.47 | 1.36 | 1.38 | 1.46 | 1.43 | 1.44 |
| Those of other alloy steel | 2.80 | 2.49 | 2.31 | 2.29 | 2.25 | 2.65 | 2.76 | 2.65 | 2.17 | 2.33 | 2.18 | 2.29 |
| Pig iron | 1.10 | 2.09 | 2.07 | 1.78 | 1.65 | 1.70 | 1.60 | 1.39 | 1.06 | 1.70 | 2.07 | 1.33 |
| Iron and steel wire,bars | 0.90 | 0.97 | 0.89 | 0.77 | 0.84 | 0.94 | 0.99 | 0.87 | 0.87 | 0.80 | 0.81 | 0.97 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 7. The ratio of Japanese RCA index to the Germany RCA index by various electrical machinery products

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Insulators | 2.25 | 2.10 | 2.17 | 1.75 | 2.09 | 2.08 | 1.86 | 1.38 | 1.30 | 0.98 | 1.28 | 1.13 |
| Condenser | 6.98 | 7.39 | 8.85 | 8.22 | 7.66 | 10.69 | 11.55 | 11.49 | 11.89 | 12.09 | 13.10 | 11.71 |
| Video rec or repro apparatus | 4.79 | 6.77 | 6.27 | 5.51 | 3.56 | 3.25 | 3.94 | 3.35 | 2.23 | 2.75 | 8.80 | 10.25 |
| Part of audio, visual apparatus | 4.98 | 5.19 | 5.28 | 5.25 | 3.91 | 4.15 | 6.03 | 7.39 | 7.21 | 6.01 | 5.44 | 4.90 |
| Audio apparatus | 4.40 | 4.11 | 3.55 | 2.93 | 2.14 | 1.76 | 1.34 | 1.11 | 0.80 | 0.70 | 0.57 | 0.52 |
| Domestic electrical equipment | 0.21 | 0.19 | 0.18 | 0.17 | 0.15 | 0.12 | 0.13 | 0.12 | 0.12 | 0.13 | 0.13 | 0.14 |
| Automotive electrical goods | 1.06 | 1.09 | 1.09 | 1.25 | 1.51 | 1.53 | 1.46 | 1.53 | 1.73 | 1.76 | 1.77 | 1.78 |
| Electrical power machinery | 1.26 | 1.18 | 1.21 | 1.14 | 1.11 | 1.04 | 0.97 | 0.98 | 0.90 | 0.87 | 0.85 | 0.79 |
| Insulated wire and cable | 0.67 | 0.65 | 0.67 | 0.70 | 0.61 | 0.59 | 0.57 | 0.63 | 0.63 | 0.57 | 0.62 | 0.65 |
| Telephoney, telegraphy | 1.33 | 1.62 | 1.49 | 1.63 | 1.30 | 0.91 | 0.88 | 0.85 | 0.76 | 0.75 | 0.87 | 1.30 |
| Electrical apparatus | 1.20 | 1.22 | 1.26 | 1.42 | 1.25 | 1.25 | 1.27 | 1.34 | 1.27 | 1.23 | 1.19 | 1.11 |
| Carbon and graphite articles | 1.38 | 1.30 | 1.44 | 1.42 | 1.51 | 1.75 | 1.67 | 1.82 | 1.94 | 2.15 | 2.03 | 2.14 |
| Electrical lamps | 0.57 | 0.56 | 0.59 | 0.64 | 0.72 | 0.79 | 0.87 | 1.05 | 1.14 | 1.40 | 1.18 | 1.18 |
| Batteries and accumulators | 4.05 | 4.09 | 5.67 | 5.95 | 3.94 | 3.79 | 4.49 | 3.61 | 3.51 | 3.65 | 3.44 | 3.97 |
| Semiconductors etc | 5.10 | 4.47 | 4.53 | 3.79 | 3.72 | 3.97 | 3.96 | 3.93 | 4.00 | 4.25 | 4.16 | 3.77 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 8. The ratio of Japanese RCA index to the Germany RCA index by various chemical products

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plastic materials | 0.55 | 0.56 | 0.60 | 0.59 | 0.61 | 0.67 | 0.70 | 0.72 | 0.74 | 0.78 | 0.83 | 0.83 |
| Medical products | 0.20 | 0.19 | 0.21 | 0.24 | 0.21 | 0.24 | 0.21 | 0.17 | 0.14 | 0.12 | 0.11 | 0.10 |
| Toilet preparation | 0.22 | 0.23 | 0.26 | 0.26 | 0.26 | 0.24 | 0.23 | 0.25 | 0.25 | 0.25 | 0.24 | 0.26 |
| Paints | 0.37 | 0.36 | 0.45 | 0.55 | 0.49 | 0.51 | 0.57 | 0.63 | 0.64 | 0.67 | 0.69 | 0.71 |
| Fertilizers | 0.13 | 0.11 | 0.12 | 0.12 | 0.12 | 0.13 | 0.12 | 0.12 | 0.10 | 0.10 | 0.11 | 0.10 |
| Inorganic chemicals | 0.58 | 0.61 | 0.68 | 0.68 | 0.70 | 0.79 | 0.86 | 0.90 | 0.87 | 0.86 | 0.91 | 0.94 |
| Organic chemicals | 0.96 | 1.10 | 1.09 | 1.00 | 1.12 | 1.18 | 1.32 | 1.29 | 1.31 | 1.23 | 1.36 | 1.19 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 9. The ratio of Japanese RCA index to the Germany RCA index by various manufactures of metal products

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nails, bolts, nuts etc | 0.99 | 0.85 | 0.91 | 0.96 | 0.98 | 0.99 | 1.00 | 0.97 | 0.94 | 0.89 | 0.91 | 0.93 |
| Wire products | 0.76 | 0.74 | 0.69 | 0.58 | 0.59 | 0.58 | 0.54 | 0.47 | 0.41 | 0.34 | 0.32 | 0.30 |
| Structural parts | 0.17 | 0.17 | 0.14 | 0.09 | 0.10 | 0.09 | 0.12 | 0.11 | 0.10 | 0.10 | 0.11 | 0.12 |
| Tools for use in hand | 0.96 | 0.83 | 0.85 | 0.86 | 0.96 | 0.90 | 0.91 | 0.95 | 0.86 | 0.84 | 0.78 | 0.80 |
| Cullery | 0.40 | 0.42 | 0.34 | 0.37 | 0.31 | 0.28 | 0.28 | 0.25 | 0.27 | 0.28 | 0.32 | 0.37 |
| Metal container | 0.18 | 0.13 | 0.14 | 0.17 | 0.16 | 0.14 | 0.18 | 0.18 | 0.16 | 0.14 | 0.14 | 0.14 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 10. The ratio of Japanese RCA index to the Germany RCA index by various machinery products

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Machine for paper or purp | 0.29 | 0.24 | 0.18 | 0.21 | 0.16 | 0.17 | 0.21 | 0.23 | 0.21 | 0.16 | 0.23 | 0.26 |
| Ball or roller bearings | 1.36 | 1.45 | 1.54 | 1.62 | 1.53 | 1.44 | 1.49 | 1.43 | 1.43 | 1.44 | 1.31 | 1.34 |
| Pump and centrifuges | 0.73 | 0.72 | 0.71 | 0.72 | 0.76 | 0.78 | 0.79 | 0.75 | 0.72 | 0.71 | 0.75 | 0.76 |
| Printing machines | 0.41 | 0.40 | 0.43 | 0.41 | 0.35 | 0.36 | 0.43 | 0.41 | 0.40 | 0.44 | 0.50 | 0.56 |
| Heating or cooling machine | 1.10 | 1.00 | 0.93 | 1.02 | 0.89 | 0.81 | 0.87 | 1.00 | 0.89 | 0.87 | 0.73 | 0.70 |
| Mechanical handling equipment | 1.00 | 0.82 | 0.76 | 0.77 | 0.75 | 0.76 | 0.88 | 1.00 | 0.91 | 0.89 | 0.88 | 0.94 |
| Metalworking machinery | 1.77 | 1.71 | 1.60 | 1.78 | 1.61 | 1.50 | 1.82 | 1.90 | 1.98 | 1.88 | 1.68 | 1.66 |
| Construction machines | 1.49 | 1.41 | 1.39 | 1.23 | 1.28 | 1.43 | 1.92 | 1.94 | 1.82 | 1.88 | 1.89 | 1.84 |
| Power generating machines | 1.22 | 1.22 | 1.14 | 1.12 | 1.17 | 1.11 | 1.07 | 1.03 | 1.04 | 0.97 | 1.12 | 1.18 |
| Textile machines | 0.72 | 0.61 | 0.64 | 0.65 | 0.74 | 0.75 | 0.82 | 0.81 | 0.77 | 0.81 | 0.85 | 0.85 |
| Parts of computer | 4.70 | 4.31 | 3.33 | 2.79 | 2.60 | 3.41 | 4.00 | 3.06 | 2.79 | 2.42 | 2.28 | 2.44 |
| Agricultural machinery | 0.35 | 0.40 | 0.45 | 0.45 | 0.43 | 0.42 | 0.47 | 0.51 | 0.52 | 0.51 | 0.46 | 0.42 |
| Semiconductor machinery etc | | | | | | | | | | | 19.86 | 15.16 |
| Computers and units | 2.94 | 2.51 | 2.20 | 1.78 | 1.96 | 1.70 | 1.06 | 0.81 | 0.68 | 0.69 | 0.86 | 0.87 |
| Food-processing machines | 0.18 | 0.13 | 0.16 | 0.18 | 0.20 | 0.19 | 0.18 | 0.19 | 0.17 | 0.16 | 0.15 | 0.15 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance

Table 11. The ratio of Japanese RCA index to the Germany RCA index by various transport equipment

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aircrafts | 0.18 | 0.20 | 0.17 | 0.12 | 0.14 | 0.11 | 0.14 | 0.11 | 0.12 | 0.14 | 0.19 | 0.17 |
| Bicycles and parts thereof | 4.15 | 4.18 | 4.16 | 4.28 | 3.26 | 3.32 | 3.89 | 4.30 | 3.50 | 2.54 | 2.70 | 2.61 |
| Motor vehicles | 1.13 | 1.17 | 1.11 | 1.04 | 1.07 | 1.17 | 1.16 | 1.17 | 1.15 | 1.34 | 1.38 | 1.45 |
| Parts of motor vehicles | 1.30 | 1.12 | 1.20 | 1.27 | 1.28 | 1.23 | 1.24 | 1.22 | 1.23 | 1.18 | 1.21 | 1.19 |
| Ships and Boats | 8.44 | 9.00 | 5.17 | 7.44 | 3.67 | 3.79 | 5.23 | 6.68 | 9.52 | 6.55 | 5.88 | 5.81 |
| Railway vehicles | 0.35 | 0.28 | 0.47 | 0.40 | 0.55 | 0.38 | 0.18 | 0.31 | 0.51 | 0.38 | 0.33 | 0.40 |
| Cycles with engines | 15.51 | 15.90 | 13.95 | 13.92 | 17.71 | 11.67 | 11.26 | 12.27 | 10.51 | 10.20 | 10.34 | 8.13 |

Notes: 1.United Nations"UN Comtrade"

2. $RCA_{ii} = (X_{ij} / \Sigma X_{ij}) / (X_{iw} / \Sigma X_{iw})$ , where $X_{ij}$ are exports in sector i in country j, and $X_{iw}$ are exports in sector i in all over the world.

3.Each product category is based on Trade statistics of Japanese Ministry of Finance