Supplementary Notes

Supplementary Note 1-1 Estimation of production inducement coefficients using the Asian International Input-Output Table

The extent to which one unit of final demand generated in Country A induces production in country A or another country is estimated using the extended Asian International Input-Output Table (2005), which is comprised of a total of ten countries: Indonesia, Malaysia, the Philippines, Thailand, China, Taiwan, South Korea, Japan and the United States. In cases where the good that is subject to the final demand is made up of many intermediate goods, any additional demand for that good induces a large amount of production in country A and other countries via the trade of the intermediate goods that are required in the production of that good.

The specific method for estimating a production inducement coefficient is as follows.

1. Structure of the Asian International Input-Output Table

$$\begin{bmatrix} X^I \\ X^M \\ \vdots \\ X^U \end{bmatrix} = \begin{bmatrix} z^{II} & z^{IM} & \cdots & z^{IU} \\ z^{MI} & z^{MM} & \cdots & z^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ z^{UI} & z^{UM} & \cdots & z^{UU} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} f^{II} & f^{IM} & \cdots & f^{IU} \\ f^{MI} & f^{MM} & \cdots & f^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ f^{UI} & f^{UM} & \cdots & f^{UU} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} + \begin{bmatrix} L^I \\ L^M \\ \vdots \\ L^U \end{bmatrix} \quad \cdots\cdots \quad (1)$$

↓ Column vector of each country's output

↓ Matrix of intermediate demand

↓ Matrix of final demand

↓ Column vector of exports to other countries and regions

Note that the indexes *I*, *M*,… *U* indicate each of the countries that make up the Asian International Input-Output Table.

2. Intermediate input

Letting the intermediate input coefficient matrix be *A*,

$$\underset{(10\times 10)}{A} = \begin{bmatrix} \alpha^{II} & \alpha^{IM} & \cdots & \alpha^{IU} \\ \alpha^{MI} & \alpha^{MM} & \cdots & \alpha^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \alpha^{UI} & \alpha^{UM} & \cdots & \alpha^{UU} \end{bmatrix} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

Here, the intermediate input coefficient α^{ij} is defined as $\alpha^{ij} \equiv \frac{Z^{ij}}{X^{j}}$ 、 $i, j = I, M, \ldots U$.

Next, we break down the final demand matrix contained in formula (1) into

$$\underset{(10\times10)}{B} = \begin{bmatrix} \beta^{II} & \beta^{IM} & \cdots & \beta^{IU} \\ \beta^{MI} & \beta^{MM} & \cdots & \beta^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \beta^{UI} & \beta^{UM} & \cdots & \beta^{UU} \end{bmatrix} \quad \text{and} \quad \underset{(10\times1)}{S} = \begin{bmatrix} S^{I} \\ S^{M} \\ \vdots \\ S^{U} \end{bmatrix} \quad \cdots\cdots\cdots\cdots\cdots\cdots \text{(3)}$$

Note, however, $\beta \equiv \frac{f^{ij}}{S^{j}}$ 、 $S^{j} \equiv \sum_{i=I}^{U} f^{ij}$ $i, j = I, M, P, \ldots, U$.

Here, if we let matrix Π be
$\Pi \equiv [I - A]^{-1} B$, then formula (1) is shown as follows.

$$X = \Pi S + [I - A]^{-1} L,$$

Note, however,

$$\underset{(10\times10)}{\Pi} = \begin{bmatrix} \pi^{II} & \pi^{IM} & \cdots & \pi^{IU} \\ \pi^{MI} & \pi^{MM} & \cdots & \pi^{MU} \\ \vdots & \vdots & \cdots & \vdots \\ \pi^{UI} & \pi^{UM} & \cdots & \pi^{UU} \end{bmatrix}$$

Here, π shows the increase in production in country i in the case one unit of final demand is generated in country j.

Supplementary Note 1–2 Estimation of price changing factors for crude oil, copper, wheat, and corn

We estimated components affecting price hikes in four internationally traded commodities including crude oil, copper, wheat, and corn, by fitting Vector Autoregression (VAR) model with two variables—inventory and price.

(1) Fitted model

$y_t = R_1 y_{t-1} + u_t$ (VAR model)

$$\begin{bmatrix} \text{year-on-year increase of world inventory} \end{bmatrix}$$

Note: For wheat and corn, comparisons are made between the global total of estimated final month-end inventory volume (monthly updated) and that of the previous year.

R_1: 2 × 2 matrix of VAR model parameters

u_t: error term

Lag-order selection: Information criteria selected a model with one lag.

(2) Decomposition of price change into three components

Using the estimated VAR model parameters, the changes in good prices are decomposed into three components: (a) Trend component that capturing the effect of price changes without inventory "shock" and price "shock", (b) Non-trend demand-supply component that capturing the effect of price changes due to changes of inventory which caused by non-trend demand-supply changes, (c) premium component that capturing the effect of random movements of price which can thought of as a price "shock" that neither trend component nor non-trend demand-supply component helps to predict. Denoting the time when the price hike started as t-k enables the decompositions of the following changes.

$$\begin{aligned} y_t &= R_1 y_{t-1} + u_t \\ &= R_1(R_1 y_{t-2} + u_{t-1}) + u_t \\ &= R_1(R_1(R_1 y_{t-3} + u_{t-2}) + u_{t-1}) + u_t \\ &= \cdots\cdots\cdots\cdots \\ &= R_1^k y_{t-k} + R_1^k u_{t-k} + \cdots\cdots + R_1 u_{t-1} + u_t \end{aligned}$$

$R_1^k y_{t-k}$: Trend component

$R_1^k u_{t-k} + \cdots\cdots + R_1 u_{t-1} + u_t$: Non-trend demand-supply component and premium component

(3) Estimation period

January 2002 to May 2008

(4) Estimation results

(a) VAR model estimation results

The estimation results applying inventory and price data for each good to the VAR model are shown in Table 1-2-1. Over all t-values, the variables of price with lag 1 are low but satisfy the claimed sign condition (minus). R-squared values are high and satisfactory.

Supplementary NoteTable 1-2-1: VAR model estimation results

Commodities	Dependant variable	Variables		R-squared	Commodities	Dependant variable	Variables		R-squared
		Inventory (–1)	Price (–1)				Inventory (–1)	Price (–1)	
Crude oil	Inventory	0.870	0.000	0.758	Wheat	Inventory	0.826	–0.003	0.725
		(16.4003)	(–0.69394)				(13.9216)	(–0.49159)	
	Price	–0.02	1.004	0.974		Price	–0.023	1.008	0.953
		(–0.12028)	(469.216)				(–0.38924)	(161.156)	
Copper	Inventory	0.928	–0.001	0.885	Corn	Inventory	0.945	0.001	0.896
		(23.8966)	(–0.19108)				(25.7054)	(0.09060)	
	Price	–0.002	1.003	0.989		Price	0.007	1.015	0.949
		(–0.17191)	(1067.140)				(0.29390)	(137.085)	

Note: Figures among parenthesis denote t-values.

(b) Decomposition results for price hikes

Assuming August 2006 as the time when the price hikes started for wheat and corn and January 2004 for crude oil and copper, we decomposed changes in price into above mentioned components for the periods starting from these commencement dates of price hikes.

As a result of the decomposition, the estimated prices reflecting inventory changes at the nearest period (May) were as follows: Crude oil: \$74.7/bbl (actual price, \$125.5/bbl), copper: \$6,300/Mt (equivalent of \$8,356/Mt), wheat: \$5.1/bu (equivalent of \$7.8 /bu), corn: \$3.1/bu (equivalent of \$6.0/bu).

(5) Data set

Crude oil price: New York Mercantile Exchange data

Copper price and inventory volume: London Metal Exchange data

Wheat and corn prices: Chicago Board of Trade data

Crude oil inventory volume: Aggregate value of monthly data provided in the following sources: *Monthly Statistical Report* (API, USA), *Energy Trend* (DTI, UK), *Amtliche Mineraloldaten* (BAFA, Germany), *Monthly Oil & Gas Survey* (IEA, France)

Wheat inventory volume: *World Agricultural Supply and Demand Estimate*s (US Department of Agriculture)

Corn inventory volume: *Grain: World Markets and Trade* (US Department of Agriculture)

Supplementary Note 2-1 Relationship between productivity and real exchange rate

(1) Assumptions

The following assumptions are made.

(a) The law of one price applies to traded goods.

(b) Labor is the only factor of production and returns to scale are constant.

(c) Perfect competition exists in the market of goods and the factor of production (labor).

(d) Labor can move freely across industries in the country.

(2) Derivation of the relation between relative labor productivity and real exchange rate

Assume that two countries, the home country and a foreign country, exist. When “P” represents the price of traded goods in the home country, "P^*" represents the price of traded goods in the foreign country, and "e" represents the rate of the foreign currency on the home country's currency basis, the following equation holds based on Assumption 1:

$$P = eP^* \quad (1)$$

Based on Assumption 2, when "w" is the hourly wage in the manufacturing industry, "η" is the labor productivity in the manufacturing industry (output/labor input [person-hour]), and "*" is the foreign country variable, the relation

$$P = w/\eta \text{ and } P^* = w^*/\eta^* \quad (2)$$

holds.

When Assumptions 1 and 2 are combined, the relation

$$w/\eta = e\, w^*/\eta^* \quad (3)$$

holds. Equation (3) can be modified into

$$\eta/\eta^* = w/e\, w^* \quad (4)$$

The left side of Equation (4) represents the relative labor productivity of the home country and foreign country and the right side represents the wage ratio of the home country and foreign country.

While commodity prices are affected by the cost of capital and intermediate goods and total factor productivity (TFP) in addition to wages, the price ratio equals the wage ratio if the effect of these factors is insignificant. In addition, the wholesale price index (WPI) or producer price index (PPI) of each country is used[1] when expressing the effective exchange rate in real terms. The producer price index covers the goods traded between companies and consists almost entirely of traded goods, despite some non-traded goods such as electricity, gas, and water supply. Thus, the expression of exchange rates in real terms is approximately considered to be based on the traded goods sector, i.e., the output price of the manufacturing industry.

The right side of Equation (4), $w/e\, w^*$ (where "w" is the wage in the manufacturing industry) becomes approximately consistent with $P'/e\, P'^*$ (where P' is the domestic producer price index). In other words,

$$\eta/\eta^* = w/e\, w^* \quad P'/e\, P'^* \quad (5)$$

(3) Data set

The spot rate of the Tokyo market in "Foreign Exchange Rates" issued by the Bank of Japan was used for the yen-dollar rate (e). Other variables were taken from EU KLEMS Database.

Supplementary Note 2-2 A questionnaire survey on the overseas market strategies of Japanese companies

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[1] Wholesale price index is used in Japan.

1. Conducted by

Japan Economic Foundation

2. Period

February through March 2008

3. Procedures

Questionnaires and answer sheets were sent to companies randomly selected from a private-sector company database and the completed answer sheets were returned by mail. The effective number of questionnaires was 4,088.

4. Number of companies that responded to the questionnaire

478

Supplementary Note Table 2-2-1: Questionnaire survey: The number of companies that responded to the questionnaire, by industry

(Unit: # of companies)

	Industry	# of companies		Industry	# of companies		Industry	# of companies
1	food & beverages	16	14	steel	10	26	telecommunication	15
2	textiles	18	15	nonferrous metals	12	27	transportation	16
3	clothing & other textile products	9	16	metal products	23	28	wholesale & retail	60
4	wood & wood products	5	17	general machinery	31	29	finance & insurance	13
5	furniture & fixtures	0	18	electric machinery	44	30	real estate	1
6	pulp, paper, & processed paper	3	19	telecommunication machinery	1	31	hotels & restaurants	3
7	printing & related jobs	1	20	electronic components & devices	11	32	medical & welfare services	0
8	chemicals	28	21	transportation machinery	31	33	education & learning support	0
9	oil & coal products	2	22	precision machinery	22	34	personal services	0
10	plastic products	15	23	other manufacturing industries	33	35	business services	4
11	rubber products	5		manufacturing industry: subtotal	325	36	other services	27
12	leather & fur products	0	24	mining	1		Non-manufacturing industry: subtotal	153
13	ceramic & cement products	5	25	construction	13		no response	0
							total	478

Supplementary Note 2-3 Verification of the Heckscher-Ohlin theorem using factor content and the regression analysis approach

The Heckscher-Ohlin theorem of comparative advantage in international trade—which states that nations (tend to) export goods that more intensively use relatively abundant factors of production, and tend to import goods that more intensively use relatively scarce factors of production—is verified in the following procedure, albeit with some data restrictions[2].

1. Determine each country's production factors endowment.
2. Confirm the relationship between export competitiveness and production factors endowment using two types of methods.
   (1) Confirmation using the factor content approach
      (1-supplement) Analysis by type of occupation in the factor of production, "labor"
   (2) Confirmation based on the regression analysis approach
3. Conclusion

1. Estimation of the amount of production factors endowment of each country (relative size)

[2] Leontief and Leamer also attempted to verify the Heckscher-Ohlin theorem.

[Subject of estimation]

○ Countries in the estimation: Japan, the U.S., Germany, France, the U.K., the Netherlands, and Finland

○ Definition of factors of production:

(a) Labor (the number of workers)

- The data on the "Number of Persons Engaged (thousands)" in the EU KLEMS database were used.

(b) Physical capital (capital stock)

- The data on the "Real Gross Fixed Capital Stock, 1995 Prices" in the EU KLEMS database were used. The real net capital stock by industry in the JIP database of RIETI was used for Japan and the data on the gross capital stock of OECD were used for France. As for Germany, the figure for the year 1991 was converted into U.S. dollars using the PPP rates of the OECD, as the 1990 figure was not available.

(c) Human capital (workers' compensation)

- The data on "Labour Compensation" in the EU KLEMS database were used and converted into U.S. dollars using the PPP rates of the OECD.

(d) Intellectual capital (cost of research and development)

- The averages of the last three years of the data, taken from the OECD Research and Development Expenditure in Industry Database, were used.

[Method of estimation]

The relative level of production factors endowment was derived from the following equation.

The production factors endowment = (the share of the factor of production, *i*, of the country concerned among the seven countries in the estimation) / (the share of the GDP of the country concerned among the seven countries in the estimation) – 1

[Results of estimation]

The rankings of the each country's production factors endowment are listed in Table 2-3-1.

- In Japan, while the endowment of "intellectual capital" was the highest in 1990, the endowment of "labor" became the highest in 1995 and 2000, which was followed by "intellectual capital."

As for other countries in 2000, the endowment of "intellectual capital" was the highest in the U.S. and Finland, while "physical capital" was the highest in Germany, France, and the Netherlands, and "labor" was the highest in the U.K.

Supplementary Note Table 2-3-1: Endowment levels of the factors of production in each country

		1990				1995				2000			
			share	endowment	ranking		share	endowment	ranking		share	endowment	ranking
Japan	real GDP	2,867,157	19.7%			3,091,830	19.2%			3,246,288	17.3%		
	labor	64,187	22.1%	0.12	2	66,632	22.4%	0.16	1	65,252	20.6%	0.19	1
	human capital	1,381,376	18.6%	-0.05	3	1,747,715	19.1%	-0.01	3	2,009,935	17.4%	0.00	4
	physical capital	5,639,861	15.7%	-0.20	4	7,407,317	17.8%	-0.07	4	9,388,807	18.6%	0.07	3
	intellectual capital	42,980	21.5%			50,890	21.6%	0.13	2	66,855	20.4%	0.18	2
U.S .	real GDP	7,055,000	48.5%	0.22	1	7,972,800	49.5%			9,764,800	52.0%		
	labor	128,832	44.4%	-0.08	4	135,850	45.6%	-0.08	3	149,968	47.3%	-0.09	3
	human capital	3,712,882	50.1%	0.03	2	4,628,915	50.5%	0.02	2	6,086,522	52.6%	0.01	2
	physical capital	16,275,036	45.4%	-0.06	3	18,520,748	44.6%	-0.10	4	22,642,297	44.8%	-0.14	4
	intellectual capital	102,932	51.5%	0.52	1	123,032	52.3%	0.06	1	183,810	56.0%	0.08	1
Germany	real GDP	1,730,064	11.9%			1,928,791	12.0%			2,130,319	11.3%		
	labor	37,598	13.0%	0.09	3	37,599	12.6%	0.05	2	39,144	12.3%	0.09	2
	human capital	899,522	12.1%	0.02	4	1,131,727	12.3%	0.03	3	1,306,336	11.3%	-0.01	3
	physical capital	5,662,199	15.8%	0.33	1	6,210,130	15.0%	0.25	1	7,420,056	14.7%	0.29	1
	intellectual capital	23,591	11.8%	0.12	2	25,551	10.9%	-0.09	4	33,296	10.1%	-0.11	4
France	real GDP	1,260,365	8.7%			1,334,773	8.3%			1,532,954	8.2%		
	labor	222,863	7.9%	-0.09	4	22,694	7.6%	-0.08	3	24,332	7.7%	-0.06	2
	human capital	607,635	8.2%	-0.05	3	709,001	7.7%	-0.07	2	885,852	7.7%	-0.06	3
	physical capital	4,397,430	12.3%	0.42	1	5,187,142	12.5%	0.51	1	6,140,718	12.2%	0.49	1
	intellectual capital	13,095	6.6%	0.07	2	17,077	7.3%	-0.12	4	20,070	6.1%	-0.25	4
U.K .	real GDP	1,184,162	8.1%			1,285,421	8.0%			1,505,879	8.0%		
	labor	27,202	9.4%	0.15	1	26,054	8.7%	0.10	1	28,021	8.8%	0.10	1
	human capital	598,769	8.1%	-0.01	3	697,724	7.6%	-0.05	2	940,687	8.1%	0.01	2
	physical capital	2,475,655	6.9%	-0.15	4	2,659,694	6.4%	-0.20	3	3,146,563	6.2%	-0.22	3
	intellectual capital	13,286	6.7%	0.07	2	14,294	6.1%	-0.24	4	17,237	5.2%	-0.35	4
Netherlands	real GDP	342,434	2.4%			383,546	2.4%			467,672	2.5%		
	labor	6,696	2.3%	-0.02	3	7,155	2.4%	0.01	2	8,115	2.6%	0.03	2
	human capital	157,535	2.1%	-0.10	4	201,947	2.2%	-0.08	3	276,630	2.4%	-0.04	3
	physical capital	1,083,605	3.0%	0.28	1	1,215,828	2.9%	0.23	1	1,434,751	2.8%	0.14	1
	intellectual capital	2,940	1.5%	0.01	2	3,197	1.4%	-0.43	4	4,502	1.4%	-0.45	4
Finland	real GDP	109,275	0.8%			105,186	0.7%			132,784	0.7%		
	labor	2,481	0.9%	0.14	1	2,053	0.7%	0.05	2	2,297	0.7%	0.02	2
	human capital	56,124	0.8%	0.01	3	56,064	0.6%	-0.06	3	73,073	0.6%	-0.11	4
	physical capital	296,419	0.8%	0.10	2	318,550	0.8%	0.17	1	357,764	0.7%	0.00	3
	intellectual capital	943	0.5%	0.00	4	1,252	0.5%	-0.19	4	2,737	0.8%	0.18	1
total	real GDP	14,548,457	100.0%			16,102,346	100.0%			18,780,696	100.0%		
	labor	289,859	100.0%			298,037	100.0%			317,128	100.0%		
	human capital	7,413,843	100.0%			9,173,093	100.0%			11,579,035	100.0%		
	physical capital	35,830,207	100.0%			41,519,410	100.0%			50,530,954	100.0%		
	intellectual capital	199,768	100.0%			235,292	100.0%			328,508	100.0%		

Unit: million dollars, the number of workers in thousands

2. Estimation of the production factors endowment embodied in international trade (net export)

The following concerns the verification of the relationship between export competitiveness and production factors endowment using the factor content approach and the regression analysis approach.

(1) Factor content approach

[Method of estimation]

Estimate the production factors endowment embodied in net exports through the following ((a) and (b)) and verify that the Heckscher-Ohlin theorem holds.

(a) The production factors endowment, *i*, embodied in exports (or imports or domestic demand) considers direct and indirect production induced by the traded goods, and is thus defined as the following using the Leontief inverse matrix.

> The production factors endowment, *i*, embodied in the exports (imports) = (input matrix vector of the factor of production) × (Leontief inverse matrix) × (trade vector)

Leontief inverse matrix: The coefficient of Leontief open inverse matrix of the input-output table of each country indicates the degree of the effect on production in each industry caused by one unit of final demand for a particular industry.

Trade vector: net export value by industry in each country

Input matrix vector of factors of production:

Labor (the number of workers/GDP) by industry

Physical capital (capital stock/GDP) by industry

Human capital (employee compensation/GDP) by industry

Intellectual capital (cost of research and development/GDP) by industry

(b) Derive the Leamer index[3].

> The Leamer index of the factor of production, *i*
> = (*i* embodied in exports – *i* embodied in imports) / *i* embodied in domestic demand
> *i* includes four types – labor, physical capital, human capital, and intellectual capital.

* The "*i* embodied in domestic demand" is estimated using the domestic production factors *i* endowment concerned.

(c) Compare the rankings of the production factors endowment embodied in traded goods derived from the domestic production factors endowment and 2 (above).

A more specific method is as follows:

- Calculate the table of Leontief inverse matrix coefficients based on the input-output table of each OECD member country. Multiply the net export value of each industry and each region of each country by the inverse matrix coefficient to arrive at the value of production induced in the industry and region concerned.
- Subsequently, calculate the amount of each factor's content, as appropriate for the induced value indicated by the trade vector, using the input matrix vector of factors of production. Assume that this is the factor of production embodied in net exports.
- Derive the Leamer index by dividing the amount of each factor content embodied in net exports by the amount of domestic supply; determine the rankings of factors of production often embodied in exports in each country based on whether the index is positive or negative and on the size of its absolute value; and compare them with the results of 1 above (Table 2-3-2). Observe that the first ranked factors of production are the same.

[Subject of estimation]

Countries in the estimation: Japan, the U.S., Germany, France, the U.K., the Netherlands, and Finland

Period of estimation: 1990 and 2000

Data set: The same data used for 1 above were used for the factors of production of each industry, and the input-output tables of the OECD member countries were used for the input-output tables.

3 The index developed by Leamer for the purpose of verifying the Heckscher-Ohlin theorem is more accurate than the method used in the Leontief Paradox.

[Results of estimation]

Supplementary Note: Table 2-3-2: The relative level of production factors endowment in the net exports of each country

Supplementary Note Table 2-3-2: The relative level of supply of the factors of production embodied in the net exports of each country

(world)

1990	labor	physical capital	human capital	intellectual capital	factor of production with the largest amount of domestic endowment	2000	labor	physical capital	human capital	intellectual capital	factor of production with the largest amount of domestic endowment
Japan	4	3	2	1	intellectual capital	Japan	4	3	2	1	labor
U.S.	4	3	2	1	intellectual capital	U.S.	4	3	2	1	intellectual capital
Germany	4	3	2	1	physical capital	Germany	4	2	3	1	physical capital
France	3	4	2	1	physical capital	France	4	2	3	1	physical capital
U.K.	1	4	3	2	labor	U.K.	4	3	2	1	labor
Netherlands	1	2	4	3	physical capital	Netherlands	1	2	4	3	physical capital
Finland	2	3	1	4	labor	Finland	1	2	3	4	intellectual capital

Note: The colored cells indicate the factors of production with the largest amount of domestic supply, which are ranked first.

[Analysis of the results]

- In Japan, intellectual capital was the highest factor embodied in net exports in both 1990 and 2000.
- Those countries in which the same factor of production was most embodied in both the level of domestic supply and exports include Japan, the U.S., and U.K. in 1990, and only the U.S. in 2000.
- Although some data restrictions apply and this is only an estimate, some results indicate that the Heckscher-Ohlin theorem does not hold.
- For reference, those industries in which the factor of production whose level of domestic supply in its country is the highest and the factor of production whose amount embodied in exports is the highest are the same are given a circle ("○") in the table below (Table 2-3-3).
- Also, industries with comparative advantage substantially differ depending on the regions of their trading partners. For instance, the only Japanese industry that had a comparative advantage against China in 1990 was mining, while six industries—including mining, chemicals, medicine, nonferrous metals, steel, and general machinery—had an advantage over the EU15. The following summarizes the industries in each country with comparative advantages over the rest of the world in 1990 and 2000.

Supplementary Note Table 2-3-3: Industries in which the factor of production whose level of domestic endowment is the highest and the factor of production whose amount embodied in exports is the highest are the same

	Japan		U.S.		Germany		France		U.K.		Netherlands		Finland	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
agriculture & food manufacturing														
textile								○	●		●	○		○
paper, pulp & publishing			●					○	●				●	
mining	●													
chemical & medical products	●	○		○	●	○			●					○
rubber & plastic products		○							●				●	○
nonferrous metals	●	○						○	●		●			○
steel	●	○	●		●				●					
general machinery		○			●	○			●					
electric machinery		○	●	○	●				●					
transportation machinery		○	●	○	●	○			●					

(1-supplement) Analysis by type of occupation in the factor of production, "labor"

The following section analyzes Japan's "labor" in further detail.

The occupation with the highest percentage of workers embodied in exports is estimated and listed in ranking with other occupations.

[Method of estimation]

In Section (1) above (factor content approach), the number of workers by major occupation was selected and analyzed as one of the factors of the factor content. For the purpose of this study, the employment matrix in the 2000 Simplified Extended Input-Output Table published by the Ministry of Economy, Trade, and Industry was integrated into 45 job categories. The process of the analysis is described below.

- Organize the output of each industry and the number of workers by occupation within the industries, and assume that the employment coefficients of the occupations (the number of workers required for the production of one million yen equals the number of workers divided by the output) are the same within one industry.
- Next, estimate the value of induced production by industry associated with the net exports of all industries in Japan and estimate the number of workers required by each industry. Since the employment coefficient of each occupation within the same industry is constant, the number of workers induced by occupation in each industry can be estimated simultaneously. Organize the number of workers induced by occupation in each industry estimated in this way across industries.
- As in the analysis of (1) above, determine the number of workers by occupation embodied in net exports as a percentage of the number of domestic workers by occupation, and develop a ranking list.

[Results of estimation]

The results are as follows (Table 2-3-4): The list is characterized by the occupations related to machinery that are ranked highly.

Supplementary Note Table 2-3-4: Rankings of occupations with a high percentage of workers embodied in exports

ranking	occupation	ranking	occupation
1	general machinery and equipment assembly/repair workers	24	natural science researchers
2	machinery, aircraft, and shipbuilding engineers	25	stationary engine, machinery, and construction machinery operators
3	measuring instruments and optical machinery assembly/repair workers	26	service workers
4	electric machinery and equipment assembly/repair workers	27	other specialized & technical workers
5	transportation machinery assembly/repair workers	28	other laborers
6	metal processing workers	29	construction engineers
7	electrical and electronic engineers	30	construction workers
8	unclassifiable jobs	31	civil & measurement engineers
9	rubber & plastic product manufacturers	32	transportation & communication workers
10	metal material manufacturers	33	agriculture, forestry and fisheries, & food engineers
11	metal refiners	34	leather, leather product manufacturers
12	data processing engineers	35	printing & bookbinding workers
13	other manufacturing and production workers	36	other engineers
14	office clerks	37	wood, bamboo, grass, and vine product
15	production process workers	38	pulp, paper & paper product manufacturer
16	transportation laborers	39	agriculture, forestry and fishery workers
17	chemical engineers	40	food product manufacturers
18	public safety workers	41	beverage & tobacco producer
19	sales workers	42	digging workers
20	managerial workers	43	ceramic & cement product manufacturers
21	specialized management workers	44	spinners
22	humanities & social science researchers	45	clothing & textile manufacturers
22	legal affairs workers		

(2) Regression analysis approach

The following estimates the factor of production embodied the most in exports using the regression analysis method.

[Analysis method]

The estimation equation used for the regression analysis is as follows:

$$T_i = f\ (X_{1i}, X_{2i}, X_{3i}, X_{4i}) = a_0 + a_{1i}X_{1i} + a_{2i}X_{2i} + a_{3i}X_{3i} + a_{4i}X_{4i}$$

T_i : net exports of Goods i (as a percentage of GDP)

X_{ji} : factors of production required for the production of Goods i (workload [j = 1], capital stock [j = 2], human capital [j = 3] and intellectual capital [j = 4]) (as percentages of GDP)

The data set for the factors of production is organized into 11 to 14 industries, as is the case in (1), depending on the data availability of each country. The net export value comes from the UN Comtrade database.

The period between 1990 and 2002 was divided into three parts and a regression analysis was performed for the seven countries in the study, using the net exports (as a percentage of GDP) as a dependent variable and the four types of factor content analyzed in Section (1) (as percentages of GDP) as explanatory variables. The sample sizes vary between 44 and 70, depending on the data availability of each country and the period (11 to 14 industries multiplied by periods of four to five years).

The factor of production with the largest coefficient and the factor of production with the highest level of domestic endowment identified in this regression analysis were compared.

[Subject of analysis]

Countries: Japan, the U.S., Germany, France, the U.K., the Netherlands, and Finland

Periods: The period between 1990 and 2002 was divided into three parts: 1990 to 1994, 1995 to 1998, and 1999 to 2002. For Germany, the period from 1990 to 1994 was substituted with a period from 1991 to 1994 due to data restrictions.

[Results of estimation]

The results of the regression analysis are as follows (Table 2-3-5):

Based on these results, the factors of production that are statistically significant (explanatory variables) were organized into Table 2-3-6. The factors of production were deemed statistically significant when their absolute t-value was 2 or higher. The factors of production that are statistically significant and whose coefficient is the largest positive value were given a circle ("○") in the table to mark them as comparatively advantageous factors of production. The factors of production with comparative advantage and the levels of domestic endowment of the factors of production were compared and are shown in Table 2-3-7.

- The results reveal that Japan maintained a comparative advantage in its intellectual capital throughout the three periods in the analysis. In contrast, the other six countries, including the U.S., indicated a comparative advantage in human capital, except for the U.K. during the two periods 1990 to 1994 and 1995 to 1998.
- Although some data restrictions apply and this is only an estimate, some results indicate that the Heckscher-Ohlin theorem does not hold.

3. Conclusion

This study has attempted to verify the relationship between export competitiveness and production factors endowment, using the factor content approach and the regression analysis approach. Although some data restrictions applied and this was only an estimate, there were some cases in which the Heckscher-Ohlin theorem did not hold.

The results of both approaches indicated that intellectual capital was highest among the factors of production embodied in the net exports of Japan, suggesting that the country's exports have been led by intellectual capital.

Supplementary Note Table 2-3-5: Result of calculations using the regression analysis approach

dependent variable: net exports/GDP

	1990-94		1995-98		1998-2002	
Japan	coefficient	t	coefficient	t	coefficient	t
intercept	-0.543	-3.200	-0.298	-1.383	-0.066	-0.355
labor (# of workers/GDP)	-3733.226	-3.445	-6725.260	-4.424	-7812.907	-5.651
human capital (workers' compensation/G	1.353	3.298	1.614	3.109	1.672	3.590
physical capital (capital stock/GDP)	0.033	1.363	0.006	0.205	-0.017	-0.652
intellectual capital (R&D cost/GDP)	5.644	6.099	4.156	3.687	2.206	2.478
coefficient of determination	0.570		0.577		0.608	
sample size	70		56		56	

	1990-94		1995-98		1998-2002	
U.S.	coefficient	t	coefficient	t	coefficient	t
intercept	-0.022	-1.038	-0.004	-0.157	-0.031	-0.775
labor (# of workers/GDP)	-39.252	-12.219	-69.321	-13.905	-127.802	-11.354
human capital (workers' compensation/G	0.967	9.718	1.384	11.347	2.169	9.305
physical capital (capital stock/GDP)	-0.004	-0.467	-0.014	-1.362	-0.021	-1.110
intellectual capital (R&D cost/GDP)	-0.819	-3.402	-1.474	-4.832	-2.409	-4.525
coefficient of determination	0.746		0.829		0.762	
sample size	60		48		48	

	1990-94		1995-98		1998-2002	
Germany	coefficient	t	coefficient	t	coefficient	t
intercept	-0.149	-1.857	-0.103	-1.294	-0.043	-0.623
labor (# of workers/GDP)	-63.856	-4.513	-135.804	-6.625	-96.911	-5.124
human capital (workers' compensation/G	2.675	4.877	4.600	6.622	3.098	5.157
physical capital (capital stock/GDP)	-0.039	-1.056	-0.093	-2.616	-0.072	-2.407
intellectual capital (R&D cost/GDP)	0.488	0.345	-2.003	-1.292	-1.390	-0.912
coefficient of determination	0.506		0.612		0.505	
sample size	56		56		56	

	1990-94		1995-98		1998-2002	
France	coefficient	t	coefficient	t	coefficient	t
intercept	-0.066	-1.375	0.021	0.479	-0.041	1.171
labor (# of workers/GDP)	-26.167	-2.836	-36.799	-3.746	-44.119	-4.100
human capital (workers' compensation/G	0.868	2.395	0.892	2.460	0.865	2.485
physical capital (capital stock/GDP)	0.016	1.131	0.003	0.234	-0.000	-0.031
intellectual capital (R&D cost/GDP)	0.777	1.393	0.893	1.544	0.469	0.697
coefficient of determination	0.317		0.473		0.508	
sample size	55		44		44	

	1990-94		1995-98		1998-2002	
U.K.	coefficient	t	coefficient	t	coefficient	t
intercept	-0.079	-1.362	0.031	0.319	-0.058	-0.463
labor (# of workers/GDP)	-9.898	-2.919	-21.421	-3.500	-53.575	-5.035
human capital (workers' compensation/G	0.460	1.501	0.750	1.480	1.952	2.987
physical capital (capital stock/GDP)	0.068	1.621	-0.017	-0.323	0.010	0.130
intellectual capital (R&D cost/GDP)	0.867	1.252	0.144	0.167	-0.798	-0.793
coefficient of determination	0.404		0.456		0.544	
sample size	60		48		48	

	1990-94		1995-98		1998-2002	
Netherlands	coefficient	t	coefficient	t	coefficient	t
intercept	0.485	4.327	0.551	5.059	0.383	5.048
labor (# of workers/GDP)	-167.717	-4.556	-225.916	-4.871	-248.516	-5.290
human capital (workers' compensation/G	3.778	2.463	4.958	3.059	5.160	3.696
physical capital (capital stock/GDP)	-0.146	-3.175	-0.199	-3.770	-0.186	-3.750
intellectual capital (R&D cost/GDP)	-1.199	0.771	-2.089	-1.192	-2.620	-1.938
coefficient of determination	0.551		0.628		0.622	
sample size	60		48		48	

	1990-94		1995-98		1998-2002	
Finland	coefficient	t	coefficient	t	coefficient	t
intercept	-0.076	-1.039	-1.039	0.254	0.130	1.521
labor (# of workers/GDP)	-85.453	-6.076	-6.076	-3.731	-131.973	-4.700
human capital (workers' compensation/G	3.810	4.849	4.849	2.739	3.374	3.088
physical capital (capital stock/GDP)	-0.029	-1.628	-1.628	-1.352	-0.054	-2.133
intellectual capital (R&D cost/GDP)	-3.906	-3.343	-3.343	-0.073	-0.865	-0.746
coefficient of determination	0.470		0.347		0.601	
sample size	60		48		48	

Supplementary Note Table 2-3-6: Summary of factors of production with statistical significance and comparative advantage

Japan

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○		○		○	
physical capital						
intellectual capital	○	●	○	●	○	●

U.S.

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○	●	○	●	○	●
physical capital						
intellectual capital	○		○		○	

Germany

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○	●	○	●	○	●
physical capital			○		○	
intellectual capital						

France

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○	●	○	●	○	●
physical capital						
intellectual capital						

U.K.

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○				○	
human capital					○	●
physical capital						
intellectual capital						

Netherlands

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○	●	○	●	○	●
physical capital	○		○		○	
intellectual capital						

Finland

	1990–94		1995–98		1998–2002	
	statistical significance	comparative advantage	statistical significance	comparative advantage	statistical significance	comparative advantage
labor	○		○		○	
human capital	○	●	○	●	○	●
physical capital					○	
intellectual capital	○					

Supplementary Note Table2-3-7 Summary of factors of production with the highest comparative advantage and level of domestic endowment

	1990-94		1995-98		1998-2002	
	comparative advantage	domestic endowment	comparative advantage	domestic endowment	comparative advantage	domestic endowment
Japan	intellectual capital	intellectual capital	intellectual capital	labor	intellectual capital	labor
U.S.	human capital	intellectual capital	human capital	intellectual capital	human capital	intellectual capital
Germany	human capital	physical capital	human capital	physical capital	human capital	physical capital
France	human capital	physical capital	human capital	physical capital	human capital	physical capital
U.K.	-	labor	-	labor	human capital	labor
Netherlands	human capital	physical capital	human capital	physical capital	human capital	physical capital
Finland	human capital	labor	human capital	physical capital	human capital	intellectual capital

Notes: The factor of production with the highest level of domestic supply in 1990 for the period between 1990 and 1994, in 1995 for the period between 1995 and 1998, and in 2000 for the period between 1998 and 2002 are listed.
Colored cells indicate the factors of production that have both comparative advantage and the highest level of domestic supply.

Supplementary Note 2-4 Definition of regional division of Japan

The names of regional divisions and of the regions divided in Section 4-1 of Chapter 2 are as shown in Table 2-4-1.

Supplementary Note Table 2-4-1: Definition of regional division of Japan

category criteria	category	regions
3 metropolitan areas	Tokyo area	Saitama, Chiba, Tokyo, Kanagawa
	Nagoya area	Gifu, Aichi, Mie
	Osaka area	Kyoto, Osaka, Hyogo, Nara
regions in Japan	Hokkaido	Hokkaido
	Tohoku	Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
	Kanto	Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa
	Koshinetsu	Niigata, Yamanashi, Nagano
	Hokuriku	Toyama, Ishikawa, Fukui
	Chubu	Gifu, Shizuoka, Aichi, Mie
	Kansai	Shiga, Kyoto, Osaka, Hyogo, Nara. Wakayama
	Chugoku	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
	Shikoku	Tokushima, Kagawa, Ehime, Kochi
	Kyushu	Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa (excluding year 1970)

Supplementary Note 2-5 A survey of the financial needs of Japanese companies

1. Conducted by
Ministry of Economy, Trade, and Industry

2. Survey period
March 30 through April 11, 2008

3. Procedures
Questionnaires and answer sheets were sent to 3,700 publicly traded companies, excluding financial institutions.

4. The number of companies that responded to the questionnaire:
455

Supplementary Note Table 2-5-1: The number of companies that responded to the questionnaire (by industry)

	industry	# of companies responded
1	agriculture, forestry & fisheries	1
2	mining	1
3	construction	21
4	manufacturing	231
5	telecommunication	23
6	transportation	10
7	wholesale & retail	73
8	finance & Insurance	6
9	real estate	12
10	hotels & restaurants	8
11	medical & welfare services	5
12	education & learning suppo	0
13	personal services	6
14	business services	11
15	other services	41
	no response	6
	total	455

Supplementary Note 2-6 RIETI-TID 2007

In Chapter 2, "RIETI-TID 2007"[4] was developed by dividing the international trade data in compliance with the United Nations' SITC (Rev.3) classification into materials, intermediate goods, and final goods for each major industry, in order to analyze the trade structure in East Asia. This section explains the basic idea behind the classification and method of developing RIETI-TID 2007.

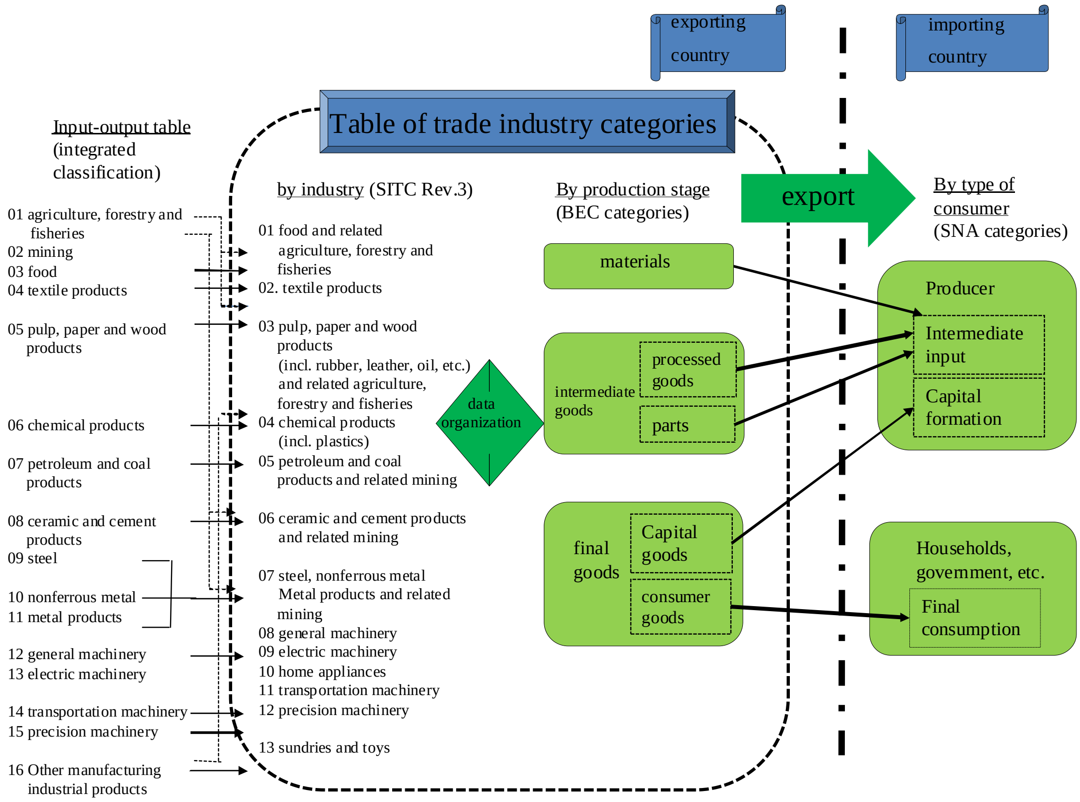
1. Basic idea

In East Asia, closer connections are developing between the international division of labor in the production process and intraregional trade. The analysis of intraregional trade among East Asian countries by production process, along with their comparison with the E.U. and NAFTA and the study of the so-called triangular trade (in which the final goods produced in East Asia are exported to the U.S. and Europe for final consumption), require the data of traded goods classified by production process. While there have been studies in which particular industries—such as electric machinery and transportation machinery—are divided between parts and finished products, and the trends in their trade are analyzed, the analysis of intraregional trade encompassing the traded goods of the entire East Asian region has been rare.

In order to understand the manufacturing industry's activities in East Asia from the trends in trade, all traded goods were classified based on the integrated classification of the input-output table of Japan and were organized by production process for each industry in order to develop RIETI-TID 2007 (Supplementary Note Figure 2-6-1).

[4] RIETI-TID 2007 was developed jointly by the Research Institute of Economy, Trade, and Industry, the Institute of Developing Economies, and the Ministry of Economy, Trade, and Industry. The trade data obtained from the category table have been organized as RIETI-TID 2007.

Supplementary Note Figure 2-6-1: Structure of RIETI-TID 2007



2. Data to be used

RIETI-TID 2007 has used the SITC data of UN Comtrade. Although the classification may yet become rougher,[5] it reflects the raw materials used in production, production stages, product descriptions, technological progress, and other factors as its characteristics,[6] which is appropriate for reflecting the inter-process division of labor.

3. Industry classification

Industries were organized into 13 sectors based on the classification of manufacturing businesses. These included agriculture, forestry and fisheries, and mining in the integrated classification (32 sectors) of the input-output table of Japan (Supplementary Note: Table 2-6-2). The classification is elaborated in the following aspects so as to efficiently reflect the progress toward inter-process division of labor in East Asia.

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[5] While HS uses six-digit classification, SITC used up to five-digit classification.

[6] The characteristics of the SITC classification are described on the U.N. website as follows: "The commodity groupings of SITC reflect (a) the materials used in production, (b) the processing stage, (c) market practices and uses of the products, (d) the importance of the commodities in terms of world trade, and (e) technological changes." The characteristics of the HS classification are as follows: "The HS contributes to the harmonization of Customs and trade procedures, and the non-documentary trade data interchange in connection with such procedures, thus reducing the costs related to international trade" (World Customs Organization). "In the Harmonized System goods are classified by what they are, and not according to their stage of fabrication, their use, or origin. The Harmonized System nomenclature is logically structured by economic activity or component material" (University of British Columbia).

(a) In the production process, raw materials, agriculture, mining, and forestry and fisheries (representing material production) are not categorized as independent industries as they are in the input-output table, but are organized as industries upstream of each respective manufacturing industry. More specifically, “food” and “pulp and paper” were categorized as “products related to agriculture, forestry, and fisheries,” while “chemical products,” “petroleum and coal products,” “ceramic and cement products,” and “steel, nonferrous metal and metal products” were categorized as “products related to mining.”

(b) Nonferrous metal and metal products were combined as one category, as their production processes can be considered similar in numerous ways. Steel was also included in that same industry, as it can only be categorized as processed goods in the BEC classification of production process.

(c) Electric machinery was divided into “electric machinery” and “home appliances,” considering the condition of the inter-process division of labor.

(d) Other industrial products were combined as “sundries and toys.” While plastics are included in “other manufacturing industries” in the classification of the input-output table, they were included in “chemical products” in view of the production process, without qualifying as “sundries and toys.”

Supplementary Note Table 2-6-2: RIETI-TID 2007

	by production stage	materials	intermediate goods		final goods	
			processed goods	parts	capital goods	consumer goods
by industry		1	2	3	4	5
1	food and related agriculture, forestry and fisheries	◎	◎		◎	◎
2	textile products	◎	◎	◎		◎
3	pulp, paper, wood products (incl. rubber, leather and oil) and related agriculture, forestry and fisheries	◎	◎	◎		◎
4	chemical products (incl. plastics)	◎	◎			◎
5	petroleum and coal products and related mining	◎	◎			
6	ceramic and cement products and related mining	◎	◎			◎
7	steel, nonferrous metal, and metal products and related mining	◎	◎	◎	◎	◎
8	general machinery		◎	◎	◎	◎
9	electric machinery		◎	◎	◎	
10	home appliances		◎	◎	◎	◎
11	transportation machinery	◎		◎	◎	◎
12	precision machinery		◎	◎	◎	◎
13	toys and sundries		◎	◎	◎	◎

4. Classification by production stage

The industries organized into 13 sectors were further classified into three categories (five sub-categories) including “raw materials,” “intermediate goods (processed goods and parts),” and “final goods (capital goods and consumer goods)”[7] (Appended Note Table 2-6-3). This represents the trade data of each industry integrated into three categories from the nature of the production process of traded goods, based on the classification of the Broad Economic Categories (BEC) of the United Nations, which were further classified by the System of National Account (SNA)[8]. Based on this,

7 Refer to “China’s Integration in Asian Production Networks and its Implications,” (F. Lemoine. et. al., (2004)) for the classification by production stage.

8 The BEC classification corresponds to the classification based on the use of basic products in the 1968

international trade data reflecting the trade structure in East Asia[9]—in which inter-process division of labor within industries is progressing—has been developed.

Supplementary Note Table 2-6-3: Classification of traded goods by production process

Category	Sub-category	BEC code	BEC Title
Primary goods		111	Food and beverages, primary, mainly for industry
		21	Industrial supplies, n.e.s., primary
		31	Fuels and lubricants, primary
Intermediate goods	Processed goods	121	Food and beverages, processed, mainly for industry
		22	Industrial supplies, n.e.s., processed
		32	Fuels and lubricants, processed
	Parts & Components	42	Parts and accessories of capital goods, except transport equipment
		53	Parts and accessories of transport equipment
Final goods	Capital goods	41	Capital goods, except transport equipment
		521	Other industrial transport equipment
	Consumption goods	112	Food and beverages, primary, mainly for household consumption
		122	Food and beverages, processed, mainly for household consumption
		51	Passenger motor cars
		522	Other non-industrial transport equipment
		61	Durable consumer goods n.e.s.
		62	Semi-durable consumer goods n.e.s.
		63	Non-durable consumer goods n.e.s.

Notes: 1. This classification table represents the traded goods in BEC categories that are linked to the criteria of System of National Account (SNA) and classified by process stage (cf. the research results of CEP II). Since SNA divides the data by user (producer, household, etc.), "capital goods (capital formation)" and "final goods (final consumption)" are separated; however, “capital goods” are considered part of “final goods” in this case, based on the idea that international trade is organized by stage of production process.

2. For BEC code 32, 321-motor spirits may be divided into "household consumption" and "use of other industrial transport equipment"; however, this distinction is not made in this case.

Supplementary Note Table 2-6-4: Overview of international trade database, “RIETI-TID 2007”

countries/regions	[Asia]	Japan, China, Hong Kong, Taiwan, Republic of Korea, Singapore, Thailand, Malaysia, Indonesia, the Philippines, Vietnam, Brunei, Cambodia and India
	[North America]	U.S. Canada and Mexico
	[Europe]	U.K., Germany, France, Italy, Spain, the Netherlands, Austria, Belgium, Greece, Luxemburg, Finland, Sweden, Ireland, Portugal, Denmark, Poland, Czech Republic, Slovakia, Hungary, Lithuania, Latvia, Slovenia, Estonia, Cyprus, Malta, Romania, Bulgaria, Russia, Turkey and Norway
	[South America]	Argentina, Brazil, Paraguay, Uruguay, Chile, Venezuela, Colombia, Ecuador, Peru, and Bolivia
	[Oceania]	Australia and New Zealand
period	1980 through 2006 (Data of some countries for certain years are missing.)	
data description	The export value and import value of the countries and regions are organized by partner country (including group and global total), by industry (13 sectors), by production process (five stages), and by year.	
notes	As a rule, import data are based on CIF (incl. cost, insurance and freight). Imports of each country to Taiwan have been converted to CIF by multiplying the export value of each country by 1.1. Since the import and export values of Singapore with Indone	

Supplementary Note 3-1 The relationship between economic growth and carbon dioxide emission intensity

(1) Estimation equation

A regression of the following equation was performed using the carbon dioxide emission intensity (based on the year 2000 exchange rate) as a dependent variable and the GDP per capita (based on real GDP of 2005) and value added of the manufacturing industry as percentages of GDP as explanatory variables.

SNA (Intermediate Consumption, Final Consumption and Gross Capital Formation).

9 The trade data are organized as RIETI-TID 2007.

$CO_2eff = \alpha \ln (perGDP) + \beta \ln (ind)$

CO_2eff: carbon dioxide emission intensity (based on the year 2000 exchange rate)
perGDP: GDP per capita (based on real GDP of 2005)
ind: value added of the manufacturing industry as a percentage of GDP

(2) Estimation period

During the year 2005

(When the year 2005 data of the value added of the manufacturing industry as a percentage of GDP were not available, the closet data after 2000 were used.)

(3) Data set

44 countries were analyzed, including the ASEAN and 6 other countries in Asia (excluding Laos due to statistical restrictions), 27 E.U. countries (excluding Cyprus and Malta due to statistical restrictions), plus the U.S., Canada, Brazil, and Russia.

Of the data used for the analysis, the carbon dioxide emission intensity and carbon dioxide emissions per capita were taken from "CO_2 Emissions from Fuel Combustion" of IEA (2007). The value added of the manufacturing industry as a percentage of GDP was obtained from the World Bank WDI database. For the countries whose 2005 data were not available, the closest available data after 2000 were used.

(4) Results of estimation]

$CO_2eff = -0.265 \ln (perGDP) + 0.997 \ln (ind)$

(t-value: – 4.85) (t-value: 6.75)