Appended Notes

Appended Note 1.1 Breakdown of variation factors for US net external assets balance as a percentage of nominal GDP[1]

[1] Refer to the following for this factor breakdown: Lane, P. R. and Milesi-Ferretti, G. M. (2002), Lane, P. R. and Milesi-Ferretti, G. M. (2005a), Lane, P. R. and Milesi-Ferretti, G.

A factor breakdown for the year-on-year increase/decrease in the net external asset balance (market prices base) against nominal GDP was carried out as follows.

(1) In principle, the variation width of the net external asset balance on a market price basis (*B*) corresponds to the total sum of the current account (*CA*) and the increase/decrease (KG) in the appraisal value of the external assets/debts resulting from factors such as changes in the asset price and exchange rates.

$$B_t - B_{t-1} = CA_t + KG_t \quad \cdot \cdot \cdot \quad [1]$$

(2) By letting i_t^{BA} stand for the rate of return on external investment against the initial net external asset balance (A_{t-1}), and i_t^{BL} stand for the rate of return on internal investment against the initial external debt balance (L_{t-1}), CA may be broken down into the non-interest current account[2] (BGST) and return on investment account ($i_t^{BA} A_{t-1} - i_t^{BL} L_{t-1}$).

$$CA_t = BGST_t + i_t^A A_{t-1} - i_t^L L_{t-1} \quad \cdot \cdot \cdot \quad [2]$$

(3) When [2] is substituted for [1], and organized using each variable as a percentage of nominal GDP,

$$b_t - b_{t-1} = bgst_t + \frac{i_t^A A_{t-1} - i_t^L L_{t-1}}{Y_t} + \frac{KG_t}{Y_t} - \frac{g_t}{1+g_t} b_{t-1} \quad \cdot \cdot \cdot \quad [3]^3$$

M. (2005b), Lane, P. R. and Milesi-Ferretti, G. M. (2006)

[2] The non-interest current account is the total sum of the balance of trade, the balance of transfer and employer remuneration.

[3] By representing the fourth item from the right in calculation [3] as economic growth results $\left(\frac{B_{t-1}}{Y_t} - \frac{B_{t-1}}{Y_{t-1}}\right)$ against b_{t-1}, the following organization may be carried out.

$$\frac{B_{t-1}}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = \frac{B_{t-1} - B_{t-1}(1+g_t)}{Y_{t-1}(1+g_t)} = \frac{b_{t-1}}{1+g_t} - b_{t-1} = \frac{b_{t-1} - b_{t-1}(1+g_t)}{1+g_t} = -\frac{g_t}{1+g_t} b_{t-1}$$

However, *g* is the nominal economic growth rate, and *b* and *bgst* equal to B, BGST divided by Y respectively.

(4)By letting kg_t^{BA} stand for initial external asset balance as a rate of the increase/decrease in the appraisal price of external assets, kg_t^{BL} stand for initial external debt balance as a rate of the increase/decrease in the appraisal value of external debts, r_t^{BA} stand for the nominal rate of return on external assets consisting of i_t^{BA} and kg_t^{BA}, and finally by letting r_t^{BL} stand for the nominal rate of return on external debts consisting of i_t^{L} and kg_t^{BL}, the following organization can be established: $r_t^A = i_t^A + kg_t^A$, $r_t^L = i_t^L + kg_t^L$.

Furthermore, since

$$kg_t^A A_{t-1} - kg_t^L L_{t-1} = KG_t \text{、} \quad \frac{L_{t-1}}{Y_t} = \frac{L_{t-1}}{Y_{t-1}} \cdot \frac{Y_{t-1}}{Y_t} = \frac{b_{t-1}}{1+g_t}$$

calculation [3] can be converted as follows:

$$b_t - b_{t-1} = bgst_t + \frac{r_t^L - g_t}{1+g_t} b_{t-1} + \frac{r_t^A - r_t^L}{1+g_t} a_{t-1} \quad \cdots [4]$$

However, a is the net external asset balance *A* as a ratio of nominal GDP.

In calculation [4], the first item from the right is the non-interest current account (≒ balance of trade) factor, the second item from the right is the disparity factor for the nominal rate of return on external debts and nominal economic growth rate (economic growth factor), and the third item from the right is the disparity factor for the nominal

rate of return on external assets and the nominal rate of return on external debt (rate of return disparity factor).

Furthermore, the rate of return disparity factor, the third item from the right in calculation [4], was broken down into the factor relating to the return on investment balance $(i_t^A - i_t^L)$ (return on investment account factor), the factor relating to the change in asset prices $(kgp_t^A - kgp_t^L)$ (asset price change factor), the factor relating to the changes in exchange rates $(kgx_t^A - kgx_t^L)$ (exchange rate change factor), and the factors relating to other changes[4] $(kgo_t^A - kgo_t^L)$ (other factors).

Specifically,

$$\frac{r_t^A - r_t^L}{1+g_t} a_{t-1} = \frac{i_t^A - i_t^L}{1+g_t} a_{t-1} + \frac{kg_t^A - kg_t^L}{1+g_t} a_{t-1}$$
$$= \frac{i_t^A - i_t^L}{1+g_t} a_{t-1} + \frac{kgp_t^A - kgp_t^L}{1+g_t} a_{t-1} + \frac{kgx_t^A - kgx_t^L}{1+g_t} a_{t-1} + \frac{kgo_t^A - kgo_t^L}{1+g_t} a_{t-1}$$

Return on investment account factor	Asset price fluctuation factor	Exchange fluctuation factor	Other factors

Appended Note 1.2 Estimating the net external debt balance according to the Domar Model

Here, as an indicator of the sustainability of external debt, the net external debt balance as a percentage of nominal GDP is utilized along with the help of the financial analysis Domar Model (constraint factors on the government bonds' issue balance to avoid

[4] This consists of the asset price changes of direct investment subsidiary companies. For details, refer to J. STEVEN LANDEFELD and ANN M. LAWSON "Valuation of the U.S. Net International Investment Position", U.S. Department of Commerce, Bureau of Economic Analysis, May 1991, p.40-49.

financial breakdown) in conducting a simulation of patterns seen in constraint factors in the United States net external debt balance—that is to say, the non-interest current account (≒balance of trade)[5] necessary to restrain the growth of net external debt balance as a percentage of GDP and maintain this at a constant level.

If one assumes that the appraisal prices relating to external assets/debts do not change, the size of the non-interest current account which will prevent a rise in the net external debt balance as a percentage of GDP is a function of actual interest rates, actual growth rates and the net external debt balance. The extent by which the balance of trade must be improved in order to prevent a rise in net external debt as a percentage of GDP increases by the extent to which actual interest rates exceed actual growth rates, and the extent of the growth in size of the initial net external debt balance.

1. Calculation of the non-interest current account as a percentage of nominal GDP necessary to prevent a rise in (stabilize) the net external debt balance as a percentage of nominal GDP.

$$d_t - d_{t-1} = (r - g)d_{t-1} - x_t$$

However,

d = the net external debt balance (market prices) as a percentage of nominal GDP
r = actual interest rates for net external debt (average rate of return on external debt – average rate of return on external assets)
g = actual growth rate
x = non-interest current account as a percentage of nominal GDP

Here, the net external debt balance as a percentage of nominal GDP at the time of the calculation $d_t - d_{t-1} = 0$ is stabilized, and therefore the non-interest current account as a percentage of nominal GDP x_t at this time is shown as follows.

$$x_t = (r - g)d_{t-1}$$

[5] Specifically, this uses the current balance minus the receipt/payment of interest, dividends etc. Therefore, it consists of the following items: balance of trade + balance of current transfers + employer remuneration.

2. Preliminary calculation for the United States

Looking at 2005, because the average rate of return on external assets exceeds that of external debt, the nominal interest on the net external debt balance was -1.0%.

As the rate of inflation for the same year was +2.1%, the actual interest rate for the net external debt was: r = -1.0% -2.1% = -3.1%.

In addition, the actual growth rate was +3.2%, and the net external debt balance (market prices) as a percentage of nominal GDP at the end of year 2004 was +20.9%.

Based on the above conditions, the non-interest current account as a percentage of nominal GDP necessary to stabilize the net external debt balance as a percentage of nominal GDP is

$(r - g)d_{t-1} = (-0.031 - 0.032) \times 20.9\% = -1.32\%$

As the actual non-interest current account as a percentage of nominal GDP was -6.5%, we can see that the extent by which the non-interest current account as a percentage of nominal GDP needs to be improved is

-1.32% - (- 6.5%) ＝ 5.2 percentage points

Appended Note 2.1　RIETI-TID 2006

In Chapter II, the RIETI-TID2006[6] was created, categorizing trade data complying with the UN's SITC (Rev. 3) category for each major industry into materials, intermediate goods and final goods, and the trade structure of East Asia was analyzed. Here, the basic philosophy behind the categories and method of creating the RIETI-TID2006 will be explained.

1. Basic philosophy

[6] RIETI-TID2006 was developed jointly by RIETI, IDE-JETRO and METI. The trade data obtained through the categorization table is organized as RIETI-TID2006.

The international division of labor in the production process and the ever closer interregional trade relationships are developing in East Asia. Trade data which categorizes trade goods according to the production process is necessary for analyzing interregional trade in East Asia by production process, for comparing East Asian interregional trade with the EU and NAFTA, and for analyzing the so-called "triangular trade" whereby final goods produced in East Asia are exported to areas which consume final goods such as the EU and United States. Up until now, surveys analyzing trade trends categorized by part and finished product have existed for specialist industries such as electric and transportation machinery, but there are few examples of comprehensive interregional trade analyses which cover East Asia trade goods as a whole.

From the perspective of understanding trade trends of East Asian manufacturing industry, the RIETI-TID2006 has been created by categorizing all trade goods based on an integrated mass categorization system of the Japanese inter-industry relations table, and then sorting each industry by production process (Appended diagram 2-1-1).

2. Data used

UN COMTRADE's SITC data was used in RIETI-TOD2006. The SITC may possibly[7] be a cruder categorization than HS, but because its special characteristic in terms of categorization is that it reflects[8] factors such as primary materials used in manufacture, the stages of manufacture, the use of products and the progress of technology, it has desirable characteristics in terms of reflecting the cross-border division of manufacturing process.

[7] HS has six-digit categories, while SITC has a maximum of five-digit.

[8] The special characteristics of the SITC categorization are explained on the UN homepage: "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." In addition, the special characteristics of the HS categorization are explained 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)

3. Categorization of industries

Regarding industries, the categories set in the integrated mass categorization system (32 categories) of the Japanese inter-industry relations table, based on the categorization of the manufacturing industries including agriculture, forestry and fisheries, and mining, were sorted into 13 industries (Appended diagram 2-1-2). The following methods were used in categorization in order to reflect more effectively the progression of cross-border division of manufacturing process in East Asia.

(1) In the case of agriculture, forestry and fisheries, and mining, which correspond to the production of materials/resources, rather than being categorized into their own industry in the manner of the inter-industry relations table, these were categorized as the upstream industries of the respective manufacturing industries to which they are related. Specifically, “food products” and “pulp/paper” were categorized into “agriculture-, forestry- and fisheries-related products” and “chemical products,” “petroleum/coal products,” “ceramic/soil and stone products,” and “iron and steel/non-ferrous metal/metal products” were categorized into “mining-related products.”

(2) As many points of similarity may be seen in the production process for non-ferrous metals and metal products, these have been sorted into a single category. In addition, with regard to iron and steel, as this is categorized only into processed goods under the Broad Economic Categories (BEC) which categorize in terms of production process, this is also included into the same industry.

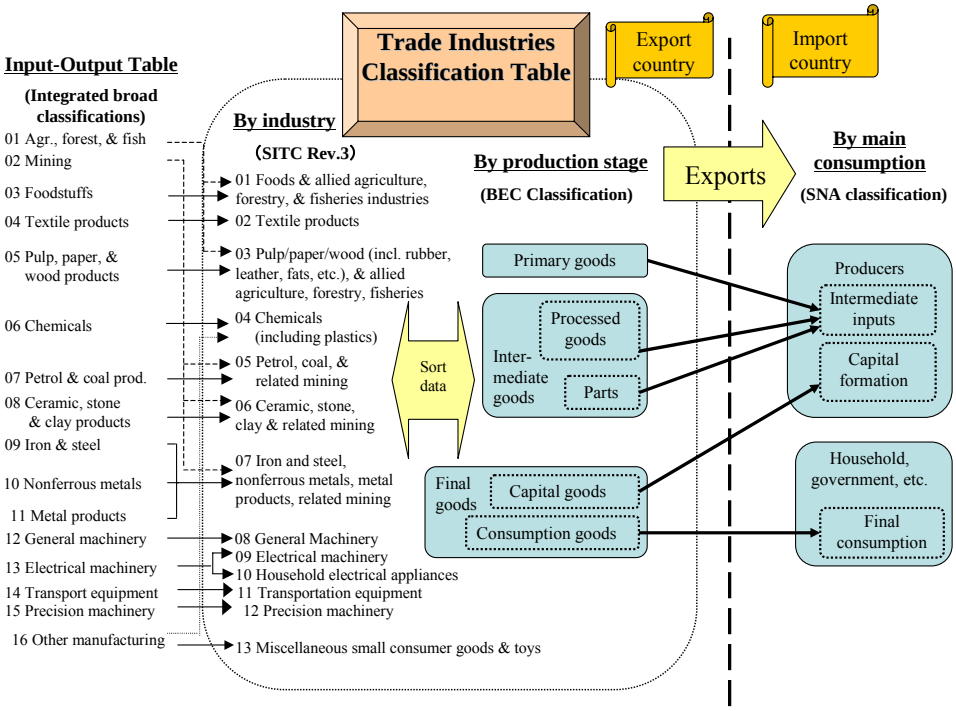
(3) Electric machinery has been divided into electric machinery and household electric machinery, based on the state of cross-border division of manufacturing process in East Asia.

(4) Other manufactured industrial products have been sorted into miscellaneous goods/toys. With regard to plastics, these have been included in the inter-industry relations table’s “other manufacturing industries,” but from the perspective of production processes these have been included in “chemical production” rather than putting them into “miscellaneous goods/toys.”

4. Categorization according to the stages of production

The industries that have been sorted into 13 fields were then categorized into three categories (five subcategories): raw materials/resources, intermediate goods (processed products, parts) and final goods (capital goods, consumer goods)[9] (Appended Table 2-1-3). This was done by compiling the trade data of various production industries into three categories according to their characteristics as trade goods within production process, based on the UN's BEC categorization, and categorizing based on the System of National Accounts (SNA)[10]. This categorization was used in creating trade data[11] that reflects the trade structure of East Asia, where the interindustry division of labor among processes is proceeding.

Appended Figure 2-1-1 Structure of RIETI-TID2006



[9] Regarding categorization according to the stage of production, please refer to F. Lemoine. et al., (2004), 'China's Integration in Asian Production Networks and Its Implications.

[10] BEC categorization was created in accordance with the SNA's 1968 categorization based on basic product usage (Intermediate consumption, Final consumption and Gross capital formation).

[11] Trade data is sorted into RIETI-TID2006.

Appended Table2-1-2 RIETI-TID 2006

By Production Stage		Primary good	Intermediate good		Final good	
			Processed good	Part & component	Capital good	Consumption good
By Industry		1	2	3	4	5
1	Foodstuffs, & allied agriculture, forestry & fisheries	◎	◎		◎	◎
2	Textile products	◎	◎	◎		◎
3	Pulp, paper & wood products (including rubber, leather & fats) & allied agriculture, forestry & fisheries	◎	◎	◎		◎
4	Chemicals (including plastic products)	◎	◎			◎
5	Petroleum and coal products, and allied mining	◎	◎			
6	Ceramic, stone & clay products, and allied mining	◎	◎			◎
7	Iron & steel, nonferrous metals, metal products & allied mining	◎	◎	◎	◎	◎
8	General machinery and equipment		◎	◎	◎	◎
9	Electrical machinery and equipment		◎	◎	◎	
10	Household electrical appliances		◎	◎	◎	◎
11	Transportation equipment	◎		◎	◎	◎
12	Precision machinery		◎	◎	◎	◎
13	Miscellaneous small consumer goods & toys		◎	◎	◎	◎

Appended Table 2-1-3 Classification of Trade 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. To create this classification table, BEC classification trade goods were related to the SNA (System of National Account) standard, and classified by process stage (refer to research results of CEPII).
In SNA, capital goods (capital formation) and final goods (final consumption) become separate items for purposes of division by main users (producer, household), but the way of thinking here is to arrange trade transactions by production process stages, so capital goods are treated as part of final goods.
2. Regarding BEC code 32, one way is to divide 321-motor spirits into that used for household consumption and that used for other industrial transport equipment, but that differentiation is not made here.
Source: Created by Ministry of Economy, Trade and Industry.

Appended Table 2-1-4 Overview of Trade Database (RIETI-TID 2006)

Countries & regions covered	**Asia:** Japan, China, Hong Kong, Taiwan, Korea, Singapore, Thailand, Malaysia, Indonesia, Philippines, Vietnam, Brunei, Cambodia, India **North America:** USA, Canada, Mexico **Europe:** UK, Germany, France, Italy, Spain, Netherlands, Austria, Belgium, Greece, Luxembourg, Finland, Sweden, Ireland, Portugal, Denmark, Poland, Czech Republic, Slovakia, Hungary, Lithuania, Latvia, Slovenia, Estonia, Cyprus, Malta, Romania, Bulgaria, Russia **South America:** Argentina, Brazil, Paraguay, Uruguay, Chile **Oceania:** Australia, New Zealand
Years covered	1980 - 2005 (However, no data exists for some years in some countries)
Content of data	Values of exports and imports of countries and regions are arranged annually by trade partner country (including groups & world totals), by industry (13 classifications), and by production process (5 stages).
Notes	• As a general rule, import data was created on a CIF basis (including freight & insurance charges). • Each country's CIF imports from Taiwan are calculated by multiplying the value of Taiwan's exports to each country by 110%. • The value of Singapore's exports and imports with Indonesia are not published, so the value of Indonesia's exports to Singapore is used as the value Singapore's imports from Indonesia, and multiplied by 110% to calculate CIF. • The total of all countries and regions except the subject country or region is "RoW (Rest of the World)". • Total world value is calculated from the total of the subject country (including Taiwan) plus RoW. • Due to data limitations, Belgium and Luxembourg are treated as one country for data purposes. Same for the Czech Republic & Slovakia.

Appended Note 2.2　Analysis of the current state of the growing economies of China and India, and a research survey relating to the overseas expansion of Japanese companies including the service industry

1. Executing agency

Japan Industrial Policy Research Institute

2. Period of survey

February 2007

3. Method of execution

A questionnaire survey form and response form were sent to 4,982 companies which have expanded overseas (a random sampling of the companies included in the Toyo Keizai Inc.'s "Comprehensive list of companies expanding overseas"); respondents mailed back their responses.

4. Companies which responded to the questionnaire
630 companies

Appended Table 2-2-1 No. of Companies Responding to Questionnaire Survey (By Industry)

(Unit: Company)

	Industry	No. of Companies Responding
1	Foodstuffs & beverages	31
2	Textiles	19
3	Apparel and other finished products made from textiles	18
4	Lumber and wood products	5
5	Furniture & fixtures	4
6	Pulp, paper, & paper products	8
7	Printing and allied industries	5
8	Chemicals	30
9	Petroleum & coal products	2
10	Plastic products	30
11	Rubber products	9
12	Leather & fur products	1
13	Ceramic, stone, and clay products	8
14	Iron & steel	10
15	Nonferrous metals	16
16	Metal products	42
17	General machinery & equipment	50
18	Electrical machinery & equipment	28
19	Information and telecommunication equipment	8
20	Electronic parts & devices	22
21	Transportation equipment	43
22	Precision machinery	15
23	Other manufacturing	65
	Manufacturing subtotal	469
24	Information services	13
25	Distribution	8
26	Wholesale & retail	90
27	Finance	19
28	Business services	2
29	Consumer services	5
30	Other services	21
	Services subtotal	158
	No response	3
	Total	630

Appended Note 2.3 Relationship between overseas production ratio and domestic businesses' product conversion ratio

In this analysis, a regression analysis was carried out using a logit model, in order to investigate the relationship between the rise in the overseas production ratio and the probability of conversion of the main products manufactured in domestic businesses.

(1) Estimation calculation

A regression analysis was carried out, with the product conversion dummy variable used as an explained variable, and company characteristics, such as overseas production ratio, as an explanatory variable.

$$\Pr(DUM^{switch}{}_{fi}^{t:t+s}) = \beta_0 + a_1(IPR_{fi,t}) + a_2(LF(Asia)_{fi,t}) + a_3(LF(adv)_{fi,t}) + a_4(X_{fi,t}) + \sum_T \delta_T(YearDum_{T,f,t}) + \sum_j \gamma_j(IndyDum_{j,fi,t}) + \varepsilon_{f,t}$$

f: Individual companies
i: Individual offices
t: Year
DUM^{switch}: Production conversion dummy
IPR: Import penetration ratio (imports/(domestic production + imports - exports)
LF(Asia): Asia production ratio
LF(adv): EU/US production ratio
X: Other companies' characteristics (initial business-scale dummy, company-scale dummy, business age, average salaries, labor productivity)
YearDum: Year dummy
IndyDum: Industry dummy

Product conversion dummy was defined as follows:

$DUM^{switch}{}_{fi}^{t:t+s} = 0$: From the period t until the period $t + s$, no change in categories of four-digit industry code.
$DUM^{switch}{}_{fi}^{t:t+s} = 1$: From the period t until the period $t + s$, there was a change (or were changes) in categories of four-digit industry code.

(2) Period of estimated calculation

From 1995 to 2000, and from 2000 to 2003.

(3) Data set

Data for machinery manufacturing was used from "Basic Survey of Japanese Business Structure and Activities," "Census of Manufacturers," and "Basic Survey of Overseas Business Activities" (METI).

Sample numbers:

Electric machinery and apparatuses (22,301), information and telecommunication equipment (4,720), electronic parts/devices (9,020), automobiles (13,941).

Appended Note 2.4 Expansion of businesses overseas and the effect upon productivity which follows

A regression analysis was carried out using companies which have expanded overseas as a sample in order to investigate what kind of effect overseas expansion have on the rises in company productivity (within Japan) over a number of years.

(1) Estimation calculation

A regression was carried out along the lines of the following calculation using a generalized method of squares. Using companies' TFO (logarithmic value) as the explained variable and the numbers of years that have passed since the companies started to expand overseas as the explanatory variable, the effect which overseas business expansion had on rises in productivity after the expansion had taken place was measured.

$$\ln(TFP_{f,t}) = \beta_0 + a_1(YearsafterFDI_{f,t}) + a_2(profit/sales_{f,t-1}) + a_3(Labor_{f,t-1}) + a_4(R\&D/sales_{f,t-1}) + \sum_T \delta_T(YearDum_{T,f,t}) + \sum_j \gamma_j(IndyDum_{j,f,t}) + \varepsilon_{f,t}$$

$$c\ln(TFP_{f,t}) = \beta_0 + a_1(YearsafterFDI_{f,t}) + a_2(profit/sales_{f,t-1}) + a_3(Labor_{f,t-1}) + a_4(R\&D/sales_{f,t-1}) + \sum_T \delta_T(YearDum_{T,f,t}) + \varepsilon_{f,t}$$

f: Individual company
t: Year
$\ln TFP$: The divergence between the company f's TFP level in the year t (the industry average TFO level in 1970) (details below)
$c\ln TFP$: The divergence between the company f's TFP level (logarithmic value) and the industry average in the year t (details below).

YearsafterFDI: relevant year – the year in which overseas expansion started (year in which FDI started)
profit/sales: Profit to sales
R&D/sales: Research and development cost ratio (research and development costs to sales volume ratio)
Labor: Number of employees
YearDum: Year dummy

IndyDum: Industry dummy

$\ln TFP$ 、 $c\ln TFP$ were computed using the following estimation calculation:
[the JIP Database (RIETI)]

$$\ln TFP_{f,t} = (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^{n} \frac{1}{2}(S_{i,f,t} + \overline{S_{i,t}})(\ln X_{i,f,t} - \overline{\ln X_{i,t}})$$
$$+ \sum_{s=1}^{t} (\overline{\ln Q_s} - \overline{\ln Q_{s-1}}) - \sum_{s=1}^{t} \sum_{i=1}^{n} \frac{1}{2}(\overline{S_{i,s}} + \overline{S_{i,s-1}})(\overline{\ln X_{i.s}} - \overline{\ln X_{i,s-1}})$$

$$c\ln TFP_{f,t} = (\ln Q_{f,t} - \overline{\ln Q_t}) - \sum_{i=1}^{n} \frac{1}{2}(S_{i,f,t} + \overline{S_{i,t}})(\ln X_{i,f,t} - \overline{\ln X_{i,t}})$$

$Q_{f,t}$: Company f's overall production output during period t
$S_{i,f,t}$: Cost share of production factors i of company f during period t
$X_{i,f,t}$: Input of production factors i of company f during period t
The overlined variables are the industry average for the relevant variable

(2) Estimation period

From 1980 to 2005

(3) Data set

For data for company characteristics, characteristics other than TFP were obtained from the Development Bank of Japan's Corporate Financial Databank, while TFP was obtained from the data for Japanese companies from the East Asian Listed Companies Database 2007 (edited by Kwon Hyeog Ug, a full-time instructor at Nihon University College of Economics and Kim Young Gak, a doctoral student of Hitotsubashi University Graduate School, and others) (EALC2007, made public on http://www.jcer.or.jp/report/asia/detail3582.html). In addition, the JIP Database 2006 (RIETI) was used as basic data for measuring the TFP at the company level.

Appended Note 2.5 Expansion of businesses overseas and the effect upon domestic performance which follows

The difference in growth rates for domestic performance between companies which had expanded overseas and those (with the same characteristics) which had not, was

computed in order to investigate what kind of effect overseas expansion was having on performance.

(1) Estimation calculation

Firstly, the following regression analysis calculation was carried out, based on the probit model using the overseas expansion dummy as the explained variable and the company's characteristics as an explanatory variable.

$$prob(FDI_{f,t}) = \beta_0 + a_1(\ln TFP_{f,t-1}) + a_2(profit/sales_{f,t-1}) + a_3(\ln Labor_{f,t-1}) + a_4(R\&D/sales_{f,t-1}) + a_5(Caplab_{t-1}) + a_6(Export/sales_{t-1}) + a_7(Age_{t-1}) + a_8(SubDum_{t-1}) + \sum_T \delta_T(YearDum_{T,f,t-1}) + \sum_j \gamma_j(IndyDum_{j,f,t-1}) + \varepsilon_{f,t}$$

f: Individual company
t: Year
prob(FDI): Overseas expansion dummy
ln(TFP): TFP level (logarithmic value) (Please refer to appended note 2.4)
profit/sales: Profit to sales
lnLabor: Number of employees (logarithmic value)
R&D/sales: Research and development cost ratio (research and development costs to sales volume ratio)
Caplab: Capital labor ratio
Export/sales: Exports to sales volume ratio (Sum of exports to sales volume)
Age: Age of operation
SubDum: Subsidiary dummy
YearDum: Year dummy
IndyDum: Industry dummy

Next, the differences in the TFP growth rate, actual production volume growth rate and employee number growth rate were computed between companies that have expanded overseas and companies that have not expanded overseas, being companies with a similar probability of expanding overseas as estimated by the above calculation.

$$\hat{\alpha}_{DID} = (y_t^{\,1} - y_{t-1}^{\,1}) - (y_t^{\,0} - y_{t-1}^{\,0})$$

y:TFP, Actual production volume and employee numbers (all logarithmic value)

(y^1: Companies which have expanded overseas; y^0: Companies which have not expanded overseas)

(2) Estimation period

From 1994 to 2002

(3) Data set

Data for companies which first expanded overseas between 1994 and 2002 from the "Basic Survey of Japanese Business Structure and Activities" (METI) was used.

Sample number: 318

(4) Estimation results

Appended Note 3.1 Relationship between overseas expansion and company characteristics

(1) Estimation calculation

Appened Table 2-5-1 Differences between Indices of Companies Expanding Overseas vs. Companies Not Expanding Overseas

Explained variable		**TFP Growth Rate**			
		Year expanded overseas	1 year later	2 years later	3 years later
Overseas expansion effect	Estimate	0.020*	0.013	0.008	0.002
	[Std. dev.]	[0.012]	[0.012]	[0.014]	[0.014]
Coefficient of determination		0.103	0.092	0.048	0.027

Explained variable		**Real Production Growth Rate**			
		Year expanded overseas	1 year later	2 years later	3 years later
Overseas expansion effect	Estimate	0.033*	0.047**	0.048**	0.063**
	[Std. dev.]	[0.017]	[0.023]	[0.027]	[0.031]
Coefficient of determination		0.127	0.016	0.101	0.060

Explained variable		**Employee Growth Rate**			
		Year invested	1 year later	2 years later	3 years later
Effect of investment	Estimate	0.014	0.029*	0.042*	0.069**
	[Std. dev.]	[0.012]	[0.017]	[0.023]	[0.029]
Coefficient of determination		0.21	0.026	0.077	0.081

Notes:
1. **Significant at the 5% level, *Significant at the 10% level.
2. Shows the differences between the actual growth rates after companies expanded overseas vs. the growth rate trend of companies that did not expand overseas.

Source: Hijzen, Inui, Todo (2007) *The Effects of Multinational Production on Domestic Performance: Evidence from Japanese Firms* (Ministry of Economy, Trade and Industry, Basic Survey of Japanese Business Structure and Activities, reedited).

The following regression analysis calculation was carried out, using a logit model with the overseas expansion dummy as the explained variable, and the company characteristics as the explanatory variable.

$$FDI_{f,t} = \beta_0 + \alpha \ln(TFP_{f,t-1}) + \beta \ln(Labor_{f,t-1}) + \gamma(Rev_{f,t-1}) + \delta \ln(Caplab_{f,t-1}) + \sum_{T=1980}^{2005} \lambda_T (YearDum_{T,t-1}) + \varepsilon_{i,t-1}$$

f: Individual company

t,T: Year

FDI: Overseas expansion dummy

For each year, a company which expanded in that year = 1, a company which did not expand in that year = 0
Companies which expanded overseas before the previous year were omitted from the sample.
In *TFP*: Divergence of TFP (logarithmic value) from the industry average
Labor: Employee number
Rev: Profit to sales volume ratio
Caplab: Capital labor ratio (actual corporeal capital stock to number of employees)
YearDum: Year dummy
β_0: Intercept
ε: Error term

(2) Estimation period

From 1980 to 2005

(3) Data set

For data for company characteristics, characteristics other than TFP were obtained from the Development Bank of Japan's Corporate Financial Databank, while TFP was obtained from the data for Japanese companies from the East Asian Listed Companies Database 2007 (edited by Kwon Hyeog Ug, a full-time instructor at Nihon University College of Economics and Kim Young Gak, a doctoral student of Hitotsubashi University Graduate School, and others) (EALC2007, made public on http://www.jcer.or.jp/report/asia/detail3582.html). In addition, RIETI's JIP Database 2006 was used as basic data for measuring TFP at the company level. The years in which the various companies made their entries overseas are according to the Toyo Keizai Inc.'s "Kaigai shinshutsu kigyou souran." The industry categories for the various companies follow the Development Bank of Japan's Corporate Financial Databank.

Sample number:

Service industry: 158 companies which have expanded overseas; 799 companies which have not expanded overseas
Manufacturing industry: 419 companies which have expanded overseas; 630 companies which have not expanded overseas

Appended Note 3.2　Breakdown of contribution of increase in actual value added to the labor input and productivity; breakdown of contribution of increase in the labor productivity to the TFP, deepening of IT capital, and to the deepening of non-IT capital

(1) Process of breakdown of actual added value

This paper broke down the increases in actual added value in the various industry sectors into [1] the contribution of labor input quantity variation, and [2] the contributions of increases in labor productivity; it then broke [2] down further into the degree of contribution of (1) changes in TFP, (2) deepening of IT capital, and (3) deepening of non-IT capital, and revealed the growth factors behind actual added value.

(2) Breakdown of the degree of contribution of increase in actual added value to the changes in labor input quantity and labor productivity

With Y representing actual added value and L labor input,

$$Y = Y / L \times L \quad \cdot \cdot \cdot [1]$$

Generally, with regard to time-series $x(t)$, $\frac{d}{dt}\ln x(t) = \dot{x}(t)/x(t)$ (1n represents the naturalized logarithm and 「・」represents the temporal differentiation) is produced, if the naturalized logarithms on both sides of [1] are considered to be the temporal differentiation,

$$\dot{Y}/Y = (\dot{Y}/L)/(Y/L) + \dot{L}/L \quad \cdot \cdot \cdot [2]$$

In other words, the equation “rate of increase in actual added value = contribution of change in labor productivity + contribution of change in labor input quantity” is produced.

(3) Breakdown of the contribution of the rate of increase in labor productivity to the rate of increase of TFP, deepening of IT capital and deepening of non-IT capital

This assumes the Cobb-Douglas Production Function made up of four production factors: TFP (*A*), IT capital (K_{IT}), non-IT capital (K_{NIT}) and labor input (*L*).

$$Y = AK_{IT}{}^{\alpha} K_{NIT}{}^{\beta} L^{1-\alpha-\beta} \quad \cdot \cdot \cdot [1]$$

If both sides of [1] are divided by *L*,

$$Y / L = A(K_{IT} / L)^{\alpha} (K_{NIT} / L)^{\beta} \quad \cdot \cdot \cdot [2]$$

is produced. Y / L on the left-hand side represents labor productivity, K_{IT} / L on the right-hand side represents the IT capital equipment rate, and K_{NIT} / L represents the non-IT capital equipment rate.

As in (2), if the temporal differentiation is used for the naturalized logarithm on both sides of [2],

$$\dot{(Y / L)} / (Y / L) = \dot{A} / A + \alpha \dot{(K_{IT} / L)} / (K_{IT} / L) + \beta \dot{(K_{NIT} / L)} / (K_{NIT} / L)$$

In other words, the "rate of increase in labor productivity = contribution of change in TFP + contribution of deepening of IT capital + contribution of deepening of non-IT capital" is produced.

(4) Data set

The above data was obtained by industry from the EU KLEMS Database. Relations between variables in above calculations and that of the EU KLEMS Database are as follows.

Y: VA_QI; Gross value added, volume indices, 1995 = 100

K_{IT} : CAPIT_QI ; ICT capital services, volume indices, 1995 = 100

K_{NIT} : CAPNIT_QI ; Non-ICT capital services, volume indices, 1995 = 100

L : LAB_QI ; Labour services, volume indices, 1995 = 100
α: CAPIT ; ICT capital compensation (share in total capital compensation)
β: CAPNIT ; Non-ICT capital compensation (share in total capital compensation)

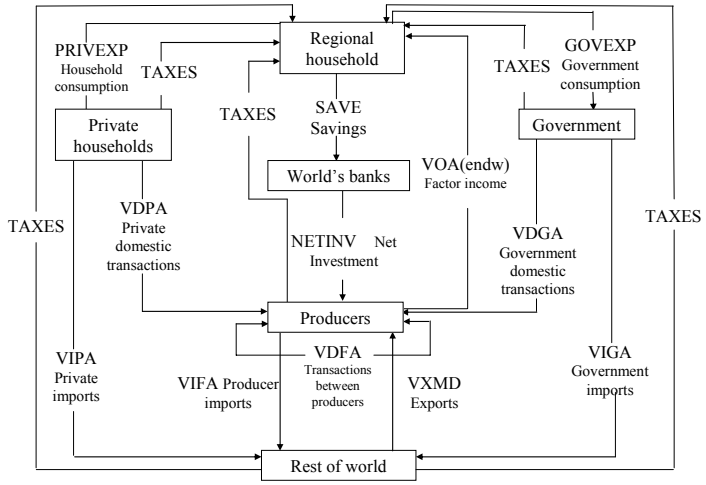
Appended Note 4.1 Outline of GTAP model using a preliminary calculation of the economic effect of EPA

In this preliminary calculation, the Global Trade Analysis Project (GTAP) model, one type of Computable General Equilibrium Model (CGE) is used. A CGE model is a preliminary calculation that sets parameters[12] under the assumption that the economy in the benchmark year represents the general equilibrium, and which, in the event that changes occur in the initial equilibrium state, is able to make a preliminary calculation of what kind of change will occur when ultimately reaching the equilibrium state once again by comparing with the initial equilibrium state[13]. The GTAP model was developed as an international trade model for measuring the economic results of trade liberalization from the GATT Uruguay Round negotiations and APEC, and particularly the effects of lowering and abolishing tariffs. However, because this model includes external variables apart from tariffs, such as the installation of taxation- and technology-related variables, and it is a model of international economy which can be used for measuring the industry-by-industry effects and effects on other regions and on the world as a whole, it has become widely used outside the realm of international trade as well, as a simulation model for various types of policies[14]. The measurement results are computed in the form of effects on actual GDP, economic welfare and terms of trade etc.

[12] Therefore, this general equilibrium is a balance which incorporates various distortions present in the benchmark year, such as domestic taxation and taxation pertaining to trade, non-tariff barriers to trade, special measures by the government to prioritize specific industry, and lack of competition as a result of the existence of monopolies. Consequently, it should be noted that a new equilibrium figure in cases where, for example, any predicted value has been applied to the external variable, incorporates the economic distortions which are present in the benchmark year.
[13] In addition, as the observed values of the benchmark year alone are relied upon for the confirmation of the equation, the model has a higher tolerance for complexity.
[14] A number of examples of simulations using the GTAP model are shown on the GTAP homepage (http://www.gtap.agecon.purdue.edu/)

The GTAP model is composed of a database for a single point using actual data, in order to create a general equilibrium, and parameters (substitution elasticity, income elasticity of demand, and own-price elasticity) which set trends among agents. At the present time, the latest database is the GTAP 6 Beta Release DataBase, which was created based on data from various countries as of 2001; using this, an analysis may be carried out of a maximum of 87 countries and 57 industries. The GTAP model system is as follows (Appended Figure 4-1-1).

Appended Figure 4-1-1 System of GTAP Model



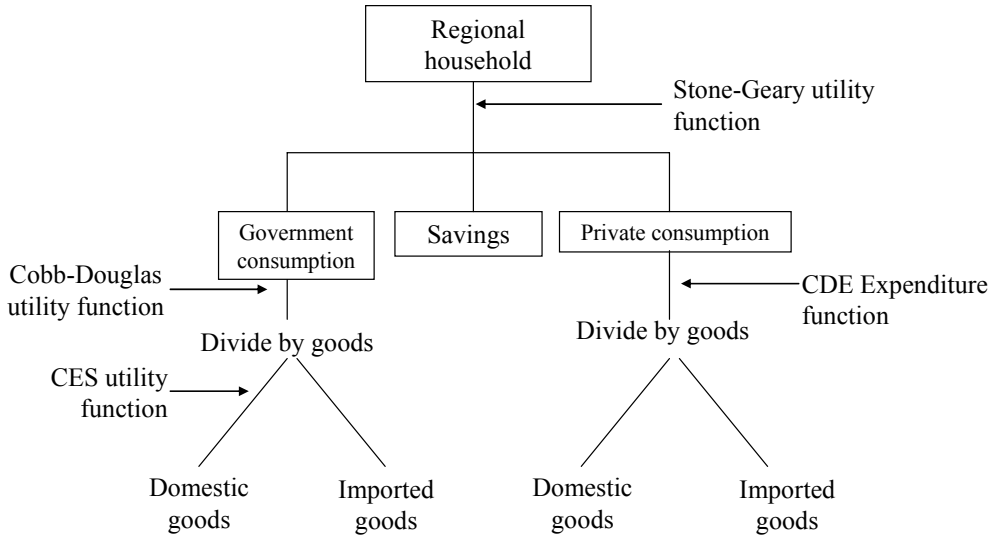
Source: *White Paper on International Economy and Trade 2003* (Ministry of Economy, Trade and Industry).

(1) Consumer behavior

In the total national economies of various countries, the regional and household budget is introduced as the agent which carries out the consumption and savings of the nation as a whole, and this is divided into two agents: private household budgets, and the government. Consumption expenditure is defined in two categories: private households' consumption expenditure and government consumption expenditure. Private household budgets obtain factor income as payment for their provision of production factors to producers (as skilled labor/non-skilled labor, capital/land/natural resources), and governments receive income taxes from private households and taxes on companies' production and trade (the balance of taxes minus subsidies) as income. The income of the regional and household budget, combining private household budgets and the government, is defined as the value of the factor income of private households and taxes on companies' production and trade minus capital depletion. Furthermore, the regional and household budget's income minus the regional and household budget's consumption expenditure represents the regional and household budget's savings.

Consumers (regional and household budget) under budget constraints move towards maximizing the Stone-Geary utility function, which includes savings as an explanatory variable; as a results of this, levels for the government expenditure for the country as a whole, savings and private household budgets are determined (Diagram 4-1-2). In the expenditure by the government for the country as a whole, demand for different kind of goods is determined by using the Cobb-Douglas function (this being divided into demand for domestic goods and demand for imported goods). In addition, by using the constant difference of elasticity (CDE) expenditure function, private household budgets' expenditure according to goods (this being divided into expenditure for domestic goods and expenditure for imported goods) can be determined even in the case of identical goods, substitutes among goods in terms of domestic goods, imported goods, and goods imported from different countries and regions are imperfect substitutability between goods from different countries (Armington hypothesis).

Attachment Figure 4-1-2 Framework of Consumer Activities



Source: *White Paper on International Economy and Trade 2003* (Ministry of Economy, Trade and Industry).

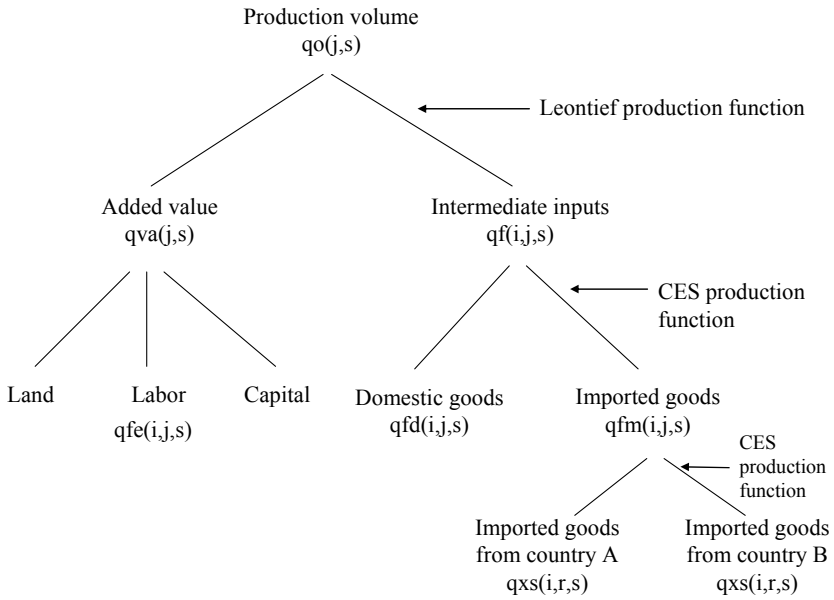
(2) Producer behavior

Producers are assumed to be the agents that supply goods and services to household budgets in their own country/region and overseas. While providing the goods and services that are appropriate to private household budgets' consumption expenditure, government consumption expenditure and exports, based on the production factors from

household budgets and the intermediate input from the domestic economy and overseas, producers also carry out investment.

Producers possess technology with constant returns to scale, and according to the Leontief production function, intermediate demand (domestic demand, and imports according to country and region) and factor demand (skilled labor/non-skilled labor, capital/land/natural resources) can be determined if given the production[15] (Diagram 4-1-3). Furthermore, exports of each good of each countries/regions are defined as the amount of production minus the consumption of the relevant goods, and thus forms the import demand for other countries.

Appended Figure 4-1-3 Framework of Producer Activities



Source: *White Paper on International Economy and Trade 2003* (Ministry of Economy, Trade and Industry).

(3) Savings/investment behavior

In the GTAP model, an agent called a "world bank" is introduced independently from each country/region in order to equalize savings and investments in each country/region across the world as a whole. Each country/region's savings are sent to the "world bank" first, and after that, savings are distributed to each country/region as net investment with

[15] For this function and other functions, values of elasticity are generally constant so as to maintain the convergence of the model. In the case of this preliminary calculation likewise, no changes are made in the parameters relating to elasticity from 2001, which is the benchmark year.

depreciation written off. The level of investment of each country is distributed according to the anticipated rate of return on capital.