Supplementary Notes 3　Input-Output Analysis Used in Section 3, Chapter 2

In Section 3, Chapter 2 in this White Paper, we use Input-Output analysis frequently.[1] However, we don't use a general Input-Output analysis but execute selection of data and improvement of calculation method based on purpose of analysis.[2] Major features of the improvement are that we use not only general competitive import type Input-Output Table but also non-competitive import type Input-Output Table. In Supplementary Notes 3, we explain about this analytical method.

Here, please realize that we use intuitive expression for people not unfamiliar with analysis technique rather than scientific accuracy, and explain about the definition repeatedly and so on.

Supplementary Notes 3-1　Differences of Input-Output Tables between the Competitive Import Type and Non-Competitive Import Type

Input-Output Tables between the Competitive Import and Non-Competitive Import Types

Definitions of the Signs in Supplementary Notes 3-1

i: line (vertical), # of intermediate goods, the left side of subscript letter

j: column (horizontal)、# of production sector, the right side of subscript letter

Here, goods produced by production sector-*i* are defined as goods-*i*.

When written as $\circ_{ij}$ in the sector, it means that goods attached to #*i* is supplied to production sector attached to #*j*.

z_{ij}: intermediate input (domestic goods + import goods)

zd_{ij}: intermediate input of domestic goods

zm_{ij}: intermediate input of import goods

f_i: domestic final demand (domestic demand)

fd_i: final demand of domestic goods

fm_i: final demand of import goods

e_i: export (foreign demand)

im_i: import

v_j: value-added

x_i, x_j: domestic production

m_i: import coefficient

In Section 3, Chapter 2, we use not only general competitive import type Input-Output Table (“Competitive Type” from now on) but also non-competitive import type Input-Output Table (“Non-Competitive Type” from now on) simultaneously and frequently.

When it comes to “Competitive Type”, in making statistical data of consumption of one type of

[1] The references in this White Paper belong to Section 3, Chapter 2.

[2] When it comes to base Input-Output-analysis, please refer to Miyazaki (2002), Shishido (2010) and Fujikawa (2005). In addition, when it comes to analysis used this time, please refer to Uda (2010), Uda (2011a) and Uda (2011b).

goods (demand), we don't discriminate between domestic goods and imported goods but treat them as things to be "competing mutually" (Competitive Type), and express in one data (Supplementary Notes Table 3-1).

On the other hand, in "Non-Competitive Type", we treat them as different goods to be "not competing mutually" (Non-Competitive), and express them as 2 divided data (Supplementary Notes Table 3-2).

Namely, the difference between "Competitive Type" and "Non-Competition Type" is whether domestic demand is shown separately between domestic demand and imports or not.

In the following section, we are going to explain taking the example of Input-Output Table that has 2 production sectors. Anyway, the definitions of signs are written in the last of the items that appear for the first time on each occasion. In addition, we express consolidated domestic consumption of final goods as "Domestic Demand", and exports as "Foreign Demand".

Supplementary Notes Table 3-1 Structure of Input-Output Table of Competitive Import Type ("Competitive Type")

		Intermediate Demand		Final Demand		Import	Domestic Production
		Production 1	Production 2	Domestic Demand	Foreign Demand		
Intermediate Input (Supply)	Goods 1	z_{11}	z_{12}	f_1	e_1	$-im_1$	x_1
	Goods 2	z_{21}	z_{22}	f_2	e_2	$-im_2$	x_2
Value Added		v_1	v_2				
Domestic Production		x_1	x_2				

Supplementary Notes Table 3-2 Structure of Input-Output Table of Non-Competitive Import Type ("Non-Competitive Type")

			Production Sector		Final Demand		Import	Domestic Production
			Production 1	Production 2	Domestic Demand	Foreign Demand		
Intermediate Input (Supply)	Domestic	Goods 1	zd_{11}	zd_{12}	fd_1	e_1	0	x_1
		Goods 2	zd_{21}	zd_{22}	fd_2	e_2	0	x_2
	Import	Goods 1	zm_{11}	zm_{12}	fm_1	0	$-im_1$	0
		Goods 2	zm_{21}	zm_{22}	fm_2	0	$-im_2$	0
Value Added			v_1	v_2				
Domestic Production			x_1	x_2				

There are following relationships between intermediate goods in Supplementary Notes Table 3-1 and intermediate goods separated between domestic and imported goods in Supplementary Notes Table 3-2.

Factorization of Intermediate Goods $z_{ij} = zd_{ij} + zm_{ij}$ (a3-1)

Factorization of Final Goods $f_i = fd_i + fm_i$ (a3-2)

Calculation of "Ratio of Domestic Production" ("Self-Sufficiency Ratio" and "Local Content Ratio")

Among "Domestic Ratio" that shows the ratio between domestic production and imports concerning industry, we use "Self-Sufficiency Ratio" and "Local Content Ratio" in Section 3, Chapter 2.[3]

"Self-Sufficiency Ratio" is, when taking vehicles as an example, the ratio of domestic vehicles against vehicles distributing in the country, namely the ratio of domestic production in component of supply.

"Self-Sufficiency Ratio" $\dfrac{x_i}{x_i + im_i}$ (Calculate Supplementary Notes Table 3-2 in lateral direction) (a3-3)

"Local Content Ratio" is, also taking vehicles as an example, ratio of domestic intermediate goods indispensable for vehicle production.

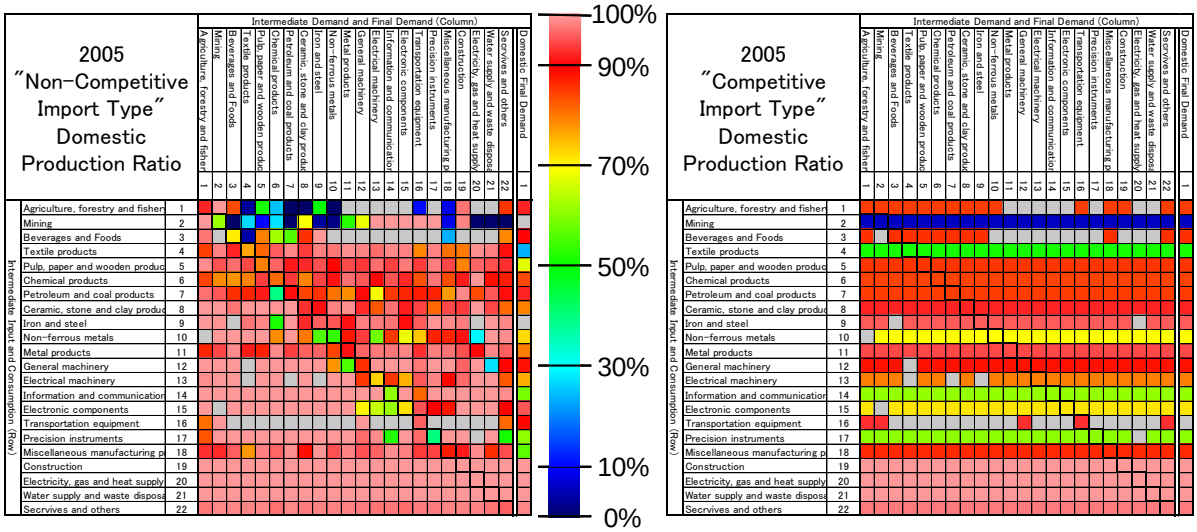
"Local Content Ratio" $\dfrac{zd_{1j} + zd_{2j}}{zd_{1j} + zd_{2j} + zm_{1j} + zm_{2j}}$

(Calculate Supplementary Notes Table 3-2 in vertical direction) (a3-4)

Difference between the Released "Non-Competitive Type" and "Non-Competitive Type Calculated under Suppositions"

It is very difficult to separate intermediate goods and final goods into domestic products and imports to modify data of "Competitive Type" into "Non-Competitive Type". Therefore, we work under the supposition that in many cases, the ratio of domestic products and imports during the input of each type of goods (colored locations in Supplementary Notes Table 3-1) to be constant as follows:

Supplementary Notes 3-3 Figure Making seeable of "Domestic Production Ratio" at consumption of each goods (Left:"Non-Competitive Type" and Right:"Competitive Type" that are separated under suppositions)



Notes: Locations where there is no deal of goods of both domestic production and imports are colored by grey.

[3] We follow the definition of Fujikawa (1998). In Fujikawa (1998), 4 kinds "Domestic Production Ratios" are used.

Ratio of Domestic Product

$$1-m_i = 1-\frac{im_1}{zd_{i1}+zd_{i2}+fd_i} \quad \text{a3-5)}$$

Ratio of Imports

$$m_i = \frac{im_1}{zd_{i1}+zd_{i2}+fd_i} \quad \text{a3-6)}$$

Extraction of Domestic Product

$$\begin{pmatrix} zd_{11} & zd_{12} & fd_1 \\ zd_{21} & zd_{22} & fd_2 \end{pmatrix} = \begin{pmatrix} 1-m_1 & 0 \\ 0 & 1-m_2 \end{pmatrix} \begin{pmatrix} z_{11} & z_{12} & f_1 \\ z_{21} & z_{22} & f_2 \end{pmatrix} \quad \text{(a3-7)}$$

Extraction of Imports

$$\begin{pmatrix} zm_{11} & zm_{12} & fm_1 \\ zm_{21} & zm_{22} & fm_2 \end{pmatrix} = \begin{pmatrix} m_1 & 0 \\ 0 & m_2 \end{pmatrix} \begin{pmatrix} z_{11} & z_{12} & f_1 \\ z_{21} & z_{22} & f_2 \end{pmatrix} \quad \text{(a3-8)}$$

Under this supposition, when extracting "Domestic Ratio" from a table that processes "Competitive Type" and actually released "Non-Competitive Type" according to each type of goods and sector that consumes, we get Supplementary Notes Figure 3-3.

Like the right side in Supplementary Notes Figure 3-3, when calculating "Domestic Ratio" under the supposition that imports ratio is constant, as ratio between domestic and imports of all intermediate goods and "Domestic Demand" (domestic consumption of final goods) are equal, all the value in column (horizontal) direction are same.

Supplementary Notes 2: Basic Calculation

Calculation of Intermediate Goods Input Coefficient

Definitions of Signs Added in Supplementary Notes 3-2

a_{ij}: intermediate input coefficient

ad_{ij}: intermediate input coefficient (only domestic)

b_{ij}: "Ripple Effect"

bd_{ij}: "Ripple Effect" (only domestic)

sf_i: inducement of "Ripple Effect" due to "Domestic Demand"

se_i: inducement of "Ripple Effect" due to "Foreign Demand"

sm_i: suppression of "Ripple Effect" due to "Import"

First of all, to see "Direct Effect" other industries receive from production of goods, we calculate volume of intermediate goods necessary to produce one unit of goods by each industry.

•"Competitive Type"

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} = \begin{pmatrix} \frac{z_{11}}{x_1} & \frac{z_{12}}{x_2} \\ \frac{z_{21}}{x_1} & \frac{z_{22}}{x_2} \end{pmatrix}$$

(Calculation using Supplementary Notes Table 3-1) (a3-9)

• "Non-Competitive Type'

$$\begin{pmatrix} ad_{11} & ad_{12} \\ ad_{21} & ad_{22} \end{pmatrix} = \begin{pmatrix} \frac{zd_{11}}{x_1} & \frac{zd_{12}}{x_2} \\ \frac{zd_{21}}{x_1} & \frac{zd_{22}}{x_2} \end{pmatrix}$$

(Calculation using Supplementary Notes Table 3-2) (a3-10)

Calculation of Leontief Inverse Matrix

Next, in order to calculate "Ripple Effect" including the direct deals of final goods and other indirect effect, it needs to calculate the so-called "Leontief Inverse Matrix". "Leontief Inverse Matrix" is "the total of direct and indirect "Ripple Effect" caused by consumption of one unit of each type of goods, which is described in the form of matrix".

• **"Competitive Type"** $$\begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \left[\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \right]^{-1} \quad \text{(a3-11)}$$

• **"Non-Competitive Type** $$\begin{pmatrix} bd_{11} & bd_{12} \\ bd_{21} & bd_{22} \end{pmatrix} = \left[\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} ad_{11} & ad_{12} \\ ad_{21} & ad_{22} \end{pmatrix} \right]^{-1} \quad \text{(a3-12)}$$

Skyline Analysis

Skyline analysis is a method used to measure direct and indirect "Ripple Effect" that "Domestic Demand" (domestic consumption of final goods), "Foreign Demand" (exports) and imports bring to each industry, and to draw a graph. In order to draw a skyline chart, first of all, one needs to make calculations of following production amount decision model. However, in this calculation, "Ripple Effect" by imports is not "Flowing Out" but "Suppressed" because "Non-Competitive Type" is used and imports are considered to be the negative demand for final goods.

• **Production amount decision model** $$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} \left[\begin{pmatrix} f_1 \\ f_2 \end{pmatrix} + \begin{pmatrix} e_1 \\ e_2 \end{pmatrix} + \begin{pmatrix} -im_1 \\ -im_2 \end{pmatrix} \right] \quad \text{(a3-13)}$$

• **Inducement by "Domestic Demand"** $$\begin{pmatrix} sf_1 \\ sf_2 \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} f_1 \\ f_2 \end{pmatrix} \quad \text{(a3-14)}$$

• **Inducement by "Foreign Demand"** $$\begin{pmatrix} se_1 \\ se_2 \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} e_1 \\ e_2 \end{pmatrix} \quad \text{(a3-15)}$$

• **Inducement Suppression by Imports** $$\begin{pmatrix} sm_1 \\ sm_2 \end{pmatrix} = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} \begin{pmatrix} im_1 \\ im_2 \end{pmatrix} \quad \text{(a3-16)}$$

• **Supply-Demand Balance** $$\begin{pmatrix} sf_1 \\ sf_2 \end{pmatrix} + \begin{pmatrix} se_1 \\ se_2 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} sm_1 \\ sm_2 \end{pmatrix} \quad \text{(a3-17)}$$

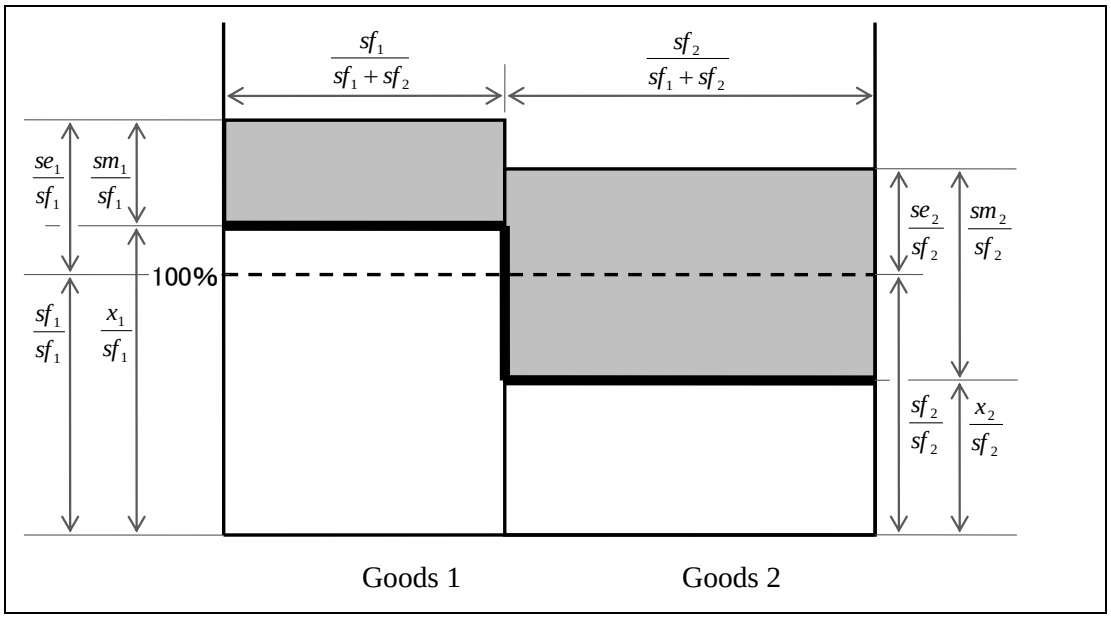
Next, we convert these values to the ratio against inducement amount by domestic demand of each sector.

Supplementary Notes Table 3-4

Data That Supplementary Notes Table 3-1 Is Processed for the Purpose of Drawing Picture

	Horizontal line		Vertical line			
			Demand		Supply	
	Production Ratio (reference)	Domestic Demand Ratio	Domestic demand	Export	Self-Sufficiency Ratio	Import
Goods 1	$\frac{x_1}{x_1 + x_2}$	$\frac{sf_1}{sf_1 + sf_2}$	$\frac{sf_1}{sf_1}$	$\frac{se_1}{sf_1}$	$\frac{x_1}{sf_1}$	$\frac{sm_1}{sf_1}$
Goods 2	$\frac{x_2}{x_1 + x_2}$	$\frac{sf_2}{sf_1 + sf_2}$	$\frac{sf_2}{sf_2}$	$\frac{se_2}{sf_2}$	$\frac{x_2}{sf_2}$	$\frac{sm_2}{sf_2}$

Supplementary Notes Table 3-5　Method to Draw Skyline Chart



As noted in "Production Ratio" (reference) in Supplementary Notes Table 3-7, although general skyline chart puts composition ratio of production amount *x* according to each section in horizontal axis, we put composition ratio of domestic demand in this White Paper.　Due to this, we can prevent the chart from being difficult to see the weak point of the domestic industry as the width of the sector whose Self-Sufficiency Rate is almost zero, like "Mining", which becomes narrow in a general skyline chart.　In addition, we use "*Ray* : Skyline Chart Drawing Tool" for drawing the skyline chart.[4]

Supplementary Notes 3-3　Calculation of "Domestic Remainder Ratio", and Calculation of "Indirect Ripple Effect"

Calculation of "Indirect Ripple Effect"

Definitions of Signs Added in Supplementary Notes 3-3

g_{ij}: Indirect Ripple Effect (domestic + import)

gd_{ij}: Indirect Ripple Effect (only domestic)

By removing "Direct Ripple Effect" from the deals of final goods, which is the origin of inducement of "Ripple Effect" from "Leontief Inverse Matrix" (total of the direct and indirect "Ripple Effect" in each sector caused by consumption of one unit of each type of final goods), we can extract "Indirect Ripple Effect".　For that purpose, it is necessary to subtract the unit matrix from "Leontief Inverse Matrix".

• **"Competitive Type"**
$$\begin{pmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{pmatrix} = \left[\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \right]^{-1} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \text{(a3-18)}$$

• **"Non-Competitive Type"**
$$\begin{pmatrix} gd_{11} & gd_{12} \\ gd_{21} & gd_{22} \end{pmatrix} = \left[\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - \begin{pmatrix} ad_{11} & ad_{12} \\ ad_{21} & ad_{22} \end{pmatrix} \right]^{-1} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \text{(a3-19)}$$

[4] When it comes to "*Ray* : Skyline Chart Drawing Tool", please refer to Uda (2011b).

“Domestic Remainder Ratio” of “Production Process” and “Whole Process”

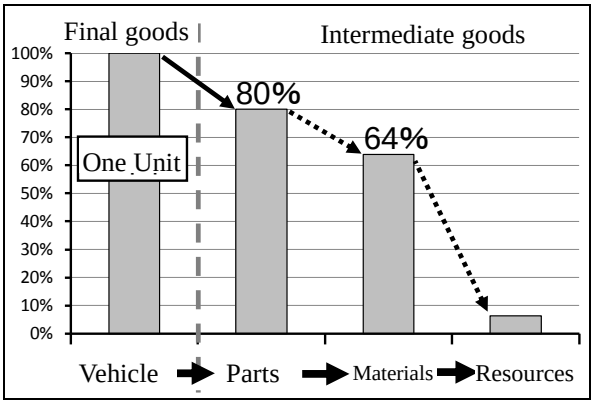
“Domestic Remainder Ratio” is the matrix that shows the ratio of domestic remainder among “Ripple Effect” in one production sector caused by consumption of one final goods. Here, we define 2 kinds of “Domestic Remainder Ratio” of “Production Process” and “Whole Process”.

“Production Process” expresses “Domestic Remainder Ratio” of “Ripple Effect” calculated based on the supposition that domestic final goods are consumed.

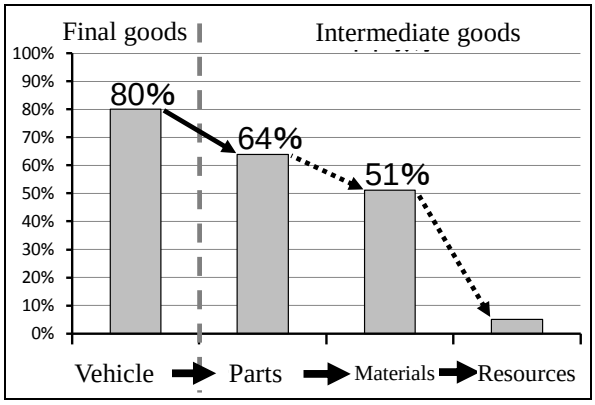
“Whole Process” expresses “Domestic Remainder Ratio” of “Ripple Effect” calculated, including selection between domestic goods or imports in consumption of final goods.

Supplementary Notes Table 3-6　Example of Change of “Domestic Remainder Ratio” by Imports

“Production Process”



“Whole Process”



Supplementary Notes Table 3-7

Deployment of “Domestic Remainder Ratio” of “Production Process”

		Consumption of final goods; Goods 1	Consumption of final goods; Goods 2
Directly	Consumption of final goods	$1=\frac{fd_1}{fd_1}$	$1=\frac{fd_2}{fd_2}$
Indirectly	Production; 1st sector	$\frac{gd_{11}}{g_{11}}\frac{fd_1}{fd_1}$	$\frac{gd_{12}}{g_{12}}\frac{fd_2}{fd_2}$
	Production; 2nd sector	$\frac{gd_{12}}{g_{12}}\frac{fd_1}{fd_1}$	$\frac{gd_{22}}{g_{22}}\frac{fd_2}{fd_2}$

Supplementary Notes Table 3-8　Deployment of "Domestic Remainder Ratio" of "Whole Process"

		Consumption of final goodps; Goods 1	Consumption of final goods; Goods 2
Directly	Consumption of final goods	$\frac{fd_1}{f_1}$	$\frac{fd_2}{f_2}$
Indirectly	Production; 1st sector	$\frac{gd_{11}}{g_{11}}\frac{fd_1}{f_1}$	$\frac{gd_{12}}{g_{12}}\frac{fd_2}{f_2}$
	Production; 2nd sector	$\frac{gd_{12}}{g_{12}}\frac{fd_1}{f_1}$	$\frac{gd_{22}}{g_{22}}\frac{fd_2}{f_2}$

We are going to explain the difference of these 2 kinds of "Domestic Remainder Ratio" of "Production Process" and "Whole Process" by using an example. In this example, we define that "Ripple Effect" flows from production of vehicles as final goods to parts, materials and resources in turn. In addition, we define that purchase ratio of domestic goods excluding resources represent a flat rate of 80%. Supplementary Notes Figure 3-6 shows the ratio of "Domestic Remainder Ratio" in "Production Process" and "Whole Process" under this condition.

Ratio in Supplementary Notes Figure 3-6 are "Domestic Remainder Ratio" of "Ripple Effect" that the vehicle (final goods) brings to each production sector. Like these values, the more the sailing up of the production process, by multiplication, the lesser "Ripple Effect" which remains domestically.

Calculation Method of "Domestic Remainder Ratio"

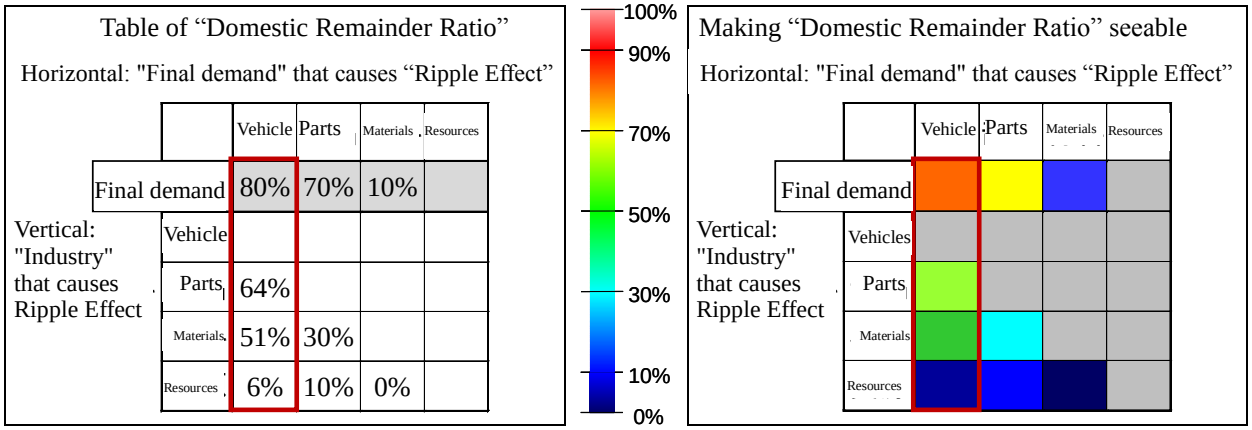
Calculation method is different for "Production Process" and "Whole Process".

This is because calculation is done under the supposition that consumption of domestic goods by final demand sector ("Domestic Demand" or "Foreign Demand") is done in case of "Production Process", while "Competition" between domestic goods and imports in consumption by final demand sector is factored into calculation in case of "Whole Process".

Expression Method of a Matrix such as "Domestic Remainder Ratio"

Next, as "Domestic Remainder Ratio" deployed in Supplementary Notes Table 3-7 and Supplementary Notes Table 3-8 are complicated, we make them visible with color using expressions of thermography. In addition, this expression of using color is used in the matrix of intermediate goods input and the matrix of "Indirect Ripple Effect" (Figure 2-2-2-3, Figure 2-2-2-4, Figures 2-2-2-7 to 2-2-2-2 -10).

Supplementary Notes, Figure 3-9　Example of the Numbers of "Domestic Remainder Ratio" and Making Them Seeable



Supplementary Notes 3-4　Calculation of "Balance of Ripple Effect"

"Balance of Ripple Effect" (Non-Competitive Type)

Definitions of Signs Added in Supplementary Notes 3-4

be_{ij}: "Inducement of Ripple Effect" by "Foreign Demand" (Export)

bm_{ij}: "Flowing Out of Ripple Effect" by Imports

bn_{ij}: "Balance of Ripple Effect" ("Inducement by Exports" minus "Flowing Out by Imports")

bfd_{ij}: "Ripple Effect" by "Domestic Demand" (Domestic Final Demand)

In Section 3, Chapter 2, we use not only general balances, such as, current account balance, trade balance and income balance, but also "Balance of Ripple Effect" is added in the analysis.　When it comes to "Balance of Ripple Effect", we define that "Ripple Effect" induced by "Foreign Demand" (Export) as "Credit", "Ripple Effect" flowing out by import as "Debit" and the gap between them as "Balance", and calculated accordingly, and we define the plus as surplus and minus as deficit like other balances.

Like other calculation methods, we use both "Competitive Type" and "Non-Competitive Type".　In these calculations, like "Domestic Remainder Ratio", we compare "Ripple Effect" with one that would have been caused if imports had not been done to obtain the real "Ripple Effect".

• **"Credit" (by exports)**

$$\begin{pmatrix} be_{12} \\ be_{22} \end{pmatrix} = \begin{pmatrix} e_1 \\ e_2 \end{pmatrix} + \begin{pmatrix} gd_{11} & gd_{12} \\ gd_{21} & gd_{22} \end{pmatrix} \begin{pmatrix} e_1 \\ e_2 \end{pmatrix} \qquad \text{(a3-20)}$$

Right side clause 1 becomes "Direct Ripple Effect", and term 2 becomes "Indirect Ripple Effect"

• **"Debit" (by imports)**

$$\begin{pmatrix} bm_{12} \\ bm_{22} \end{pmatrix} = \left[\begin{pmatrix} fd_1 + e_1 \\ fd_2 + e_2 \end{pmatrix} - \begin{pmatrix} f_1 + e_1 \\ f_2 + e_2 \end{pmatrix} \right] + \left[\begin{pmatrix} gd_{11} & gd_{12} \\ gd_{21} & gd_{22} \end{pmatrix} \begin{pmatrix} fd_1 + e_1 \\ fd_2 + e_2 \end{pmatrix} - \begin{pmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{pmatrix} \begin{pmatrix} f_1 + e_1 \\ f_2 + e_2 \end{pmatrix} \right] \qquad \text{(a3-21)}$$

Right side term 1 becomes "Direct Ripple Effect" flowing out by imports of final goods, and clause

2 becomes “Indirect Ripple Effect” flowing out in production process due to imports.

• **“Balance of Ripple Effect”** $\begin{pmatrix} bn_1 \\ bn_2 \end{pmatrix} = \begin{pmatrix} be_1 \\ be_2 \end{pmatrix} - \begin{pmatrix} bm_1 \\ bm_2 \end{pmatrix}$ (a3-22)

“Balance of Ripple Effect” can be decided by calculation to seek the gap between “Credit” (inducement by exports) and “Debit” (flowing out by imports).

• **Inducement Amount by “Domestic Demand”** $\begin{pmatrix} bfd_1 \\ bfd_2 \end{pmatrix} = \begin{pmatrix} fd_1 \\ fd_2 \end{pmatrix} + \begin{pmatrix} gd_{11} & gd_{12} \\ gd_{21} & gd_{22} \end{pmatrix} \begin{pmatrix} fd_1 \\ fd_2 \end{pmatrix}$ (a3-23)

When it comes to the values, for the sake of comparison, all ratios are calculated by making “Ripple Effect” caused by “Domestic Demand” to be the denominator.

Formula to Calculate Production

“Domestic Production” is the total of “Ripple Effect” caused by each final demand. When it comes to “Non-Competitive Type”, the imports are treated as endogenous variable so that the production can be calculated by adding up “Ripple Effect” of “Domestic Demand” and “Ripple Effect” of “Foreign Demand”. A turnout is found if I add up “Ripple Effect” of “Domestic Demand” and “Ripple Effect” of “Foreign Demand” to handle imports as endogenous variables in the case of “Non- Competitive Type”.

On the other hand, when it comes to “Competitive Type”, the imports are treated as exogenous variables when using Formula to calculate production amount transposing formula a3-17.

• **“Competitive Type”** $\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} bfd_1 \\ bfd_2 \end{pmatrix} + \begin{pmatrix} be_1 \\ be_2 \end{pmatrix}$ (a3-24)

• **“Non-Competitive Type”** $\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} sf_1 \\ sf_2 \end{pmatrix} + \begin{pmatrix} se_1 \\ se_2 \end{pmatrix} - \begin{pmatrix} sm_1 \\ sm_2 \end{pmatrix}$ (a3-25)

Calculation of Employment Effect

We use “Employment List” that is an attachment of “Input-Output Table” to calculate employment. “Employment List” shows the number of the employees in each production sector, and “Employment Coefficient” is calculated by dividing the number of employees in each sector by Domestic Production. This “Employment Coefficient” shows the number of newly employed people by production of ¥1,000 thousands at each sector. By multiplying this by the amount of “Ripple Effect” occurring in each sector, the number of employment caused by ripple to production can be calculated. In addition, like production amount, inducement effect of employment can be divided and shown according to “Domestic Demand” and “Foreign Demand” according to sources of inducement in this calculation.