

## **Overview of Compilation Method of the Updated Input-Output Tables**

### **1. Characteristics of these tables**

- [1] These tables are Updated estimates of “2005 Input-Output Tables” (hereinafter referred to as “2005 Basic Tables”) compiled jointly by ten offices, ministries and agencies, including the Ministry of Internal Affairs and Communication.
- [2] Updated Input-Output Tables (hereinafter referred to as “Updated Tables”) have been compiled since 1973, with a break period from 2000 to 2003. From 2004 to 2007, Updated Tables were compiled based on the 2000 tables, and since 2008 they have been compiled based on revised 2005 tables.
- [3] The concept, definition, scope, etc. of these tables are the same as those of the 2005 Basic Tables, except for two points: no particular reference was made to the category of “self transport (passengers and freight),” and “consumption, including social capital” was not dealt with.
- [4] Estimates of each item, including production values, complied with the estimate method used for the 2005 Tables to the utmost extent.
- [5] As for consumption tax, the respective transaction prices were shown as gross values included in consumption tax, and it complies with the 2005 Tables.
- [6] Transaction prices were treated by competitive import type.
- [7] Transaction price tables were estimated based on the basic sector classification, and published based on the basic classification.
- [8] A deflator for reevaluation (realization) of each transaction price to the 2005 fixed-price value was also compiled based on the basic sector classification.

### **2. Differences Compared with the 2005 Basic Tables**

#### **(1) Handling of self-transport**

These tables indicate transportation activities by private cars as activities of each production sector in the light of analysis, etc., and thus, do not set a “self transport” sector.

Therefore, if the “iron and steel” sector conducts transportation activities using private cars, the costs are recorded in a lump at the intersection of “iron and steel” and “self transport” in the Basic Tables, but in these tables, the necessary costs for each activity, such as light oil, work clothes, and non-life insurance, are classified into each item and recorded at the intersection of the “iron and steel” sector column and each goods and services sector row. Specifically, the costs are estimated based on the adjusted Basic Tables using the “Tables on Self Transports,” which are supplementary tables of the Basic Tables.

#### **(2) Handling of consumption, including social capital**

Government social capital which began to be handled from 2000 is not handled in the Updated Tables intended for analysis, because only consumption expenditure of the government

(consumption including social capital) in the final demand sector and depreciation of fixed capital (consumption including social capital) in the gross value-added sector are recorded, resulting in an increase in the exogenous sector. Therefore, they are estimated based on the Basic Tables with consumption, including social capital, excluded.

**(3) “Consumption expenditure outside households” and “compensation of employees”**

As for the gross value-added sector, “lodging expenses and daily allowances,” “social expenses,” and “welfare expenses” in the Basic Tables are collected into “consumption expenditure outside households” and “wages and salaries.” “contribution of employers to social insurance,” and “other payments and allowances” are also collected into “compensation of employees.”

**(4) Handling of branch numbers**

Although scrap and by-products, trade margins, and freight margins are indicated separately with or without branch numbers after seven-digit row codes in the Basic Tables, they are indicated as seven-digit row codes regardless of whether there are branch numbers or not. Transaction prices in sectors with a large output of scraps and by-products may be indicated in negative values because the output of scraps and by-products are recorded as a negative value.

**3. Overview of compilation work**

Compilation work of these tables is classified roughly into the following nine steps.

- (1) Data collection
- (2) Domestic production estimates
- (3) Import and export value estimates
- (4) Gross domestic supply value estimates
- (5) Domestic final demand value estimates
- (6) Estimates in the reuse and recycling sector
- (7) Input value (intermediate input and value added values) estimate (compilation of trial balance)
- (8) Balance adjustment
- (9) Compilation of fixed-price value tables (real tables)

**4. Data collection**

These tables are compiled in accordance with the Basic Tables to the utmost extent. Data used at each compilation step are described in the following individual items.

**5. Domestic production estimates**

**(1) Nominal values (market value)**

Domestic production estimates are arrived at using an amount series based on production values by detailed item (producers’ price value) in each row sector (column sector in some sectors).

The estimate method is that of estimating the production value at the market value (nominal production value) by multiplying the production value in the 2005 Basic Tables by the growth rate of the amount series compared with 2005. However, if materials of amount series cannot be obtained, it is estimated by multiplying the production value in the 2005 Basic Tables by the growth rate or quantity series and price series (unit price series).

Production value in Updated Tables (nominal) = Production value in 2005 Basic Tables × Growth rate of amount series

(In cases where amount series cannot be obtained)

Production value in Updated Tables (nominal) = Production value in 2005 Basic Tables × Growth rate of quantity series × Growth rate of price series

## (2) Deflator

Price series which sets 2005 as 1 is estimated in each row sector. As for price series, the adopted series was decided based on the series adopted in the 1995-2000-2005 Linked Input-Output Tables. Specifically, such price series is mainly estimated by various price indices except for goods, while in sectors where the unit price (amount/quantity) can be estimated, the price series is often estimated by the unit price for goods. In cases where there are more than one price series in each row sector, such price series are estimated by the formula below.

$$P_K = \frac{\sum_k v_k}{\sum_k (v_k / p_k)}$$

Notes: P: Deflator    v: Nominal production value in the target year  
p: Growth rate of price series compared with 2005    K: Row sector item    k: Detailed item

## (3) Real values (fixed-price value)

Real values were compiled by nominal production values/deflator in each row sector.

#### (4) Estimate materials

Major materials used for estimates are as follows.

Agriculture, forestry and fishery / Beverage and Food Sectors	Statistics of Agricultural Income Produced, Crop Survey, Statistical Survey on Prices in Agriculture, Survey on Vegetable and Fruit Wholesale Markets, Statistics on Production and Shipment of Vegetables, Statistics on Production and Shipment of Fruits and Nuts, Statistics on Production and Shipment of Flowers, Statistics on Milk and Dairy Products, Statistics on Livestock Products Marketing, Materials related to Minor Forest Products, Annual Statistics on Fisheries and Aquaculture Production, Annual Report on Tokyo Metropolitan Central Wholesale Market, Survey on Movement of Food Industry, Survey of Fishery Products Marketing, etc.
Mining and Manufacturing Sector	Census of Manufactures, Current Survey of Production, Survey on Shipbuilding and Engineering, Survey on Current Rolling Stock Production, Corporate Goods Price Index, etc.
Service Sector	Indices of Tertiary Industry Activity, Statistics of Building Activities and Losses, General Construction Statistics, Yearbook of Local Public Enterprises, Handbook of Electric Power Industry, Handbook of Gas Industry, Handbook of Heat Supply Business, Current Survey of Commerce, Financial Statements Statistics of Corporations by Industry, Survey on Rolling Stock Transport, Information and Communication Technology Survey, Survey of Selected Service Industries, Current Survey of Selected Service Industries, Yearbook of Local Financial Statistics, School Basic Survey, Survey of Research and Development, Leisure White Paper, Report on Worker Dispatching Undertaking, Financial Statements, Family Income and Expenditure Survey, Corporate Service Price Index, Consumer Price Index, etc.

#### (5) Pattern of production estimates (reference)

Production estimates are arrived at using the growth rate of amount series (index) as described in (1), and they are classified into the following four estimate types A to D due to the characteristics of estimated data.

Type A is data that obtains both a quantity series and unit price series in the same statistics, and results in obtaining production amount. For example, data obtained from Current Survey of Production falls under this type. Type B is data that obtains only amount series, type C is data that obtains only quantity series, and Type D is data that obtains only price series.

In principle, price series index is estimated with the Paasche formula, while the quantity series index is estimated with the Laspeyres formula.

As for a deflator, even in the sectors where production values are estimated by Type A, other price series indexes, such as Corporate Goods Price Index, are used in some cases.

Pattern of production estimates

Estimate type	Amount series index	Quantity series index	Price series index
A	$\frac{\sum P_k^t Q_k^t}{\sum P_k^0 Q_k^0}$	$\frac{\sum P_k^0 Q_k^t}{\sum P_k^0 Q_k^0}$	$\frac{\sum P_k^t Q_k^t}{\sum P_k^t Q_k^0}$
B	$\left( \frac{\sum V_k^t S_k}{V_k^0} \right) / \sum S_k$	_____	_____
C	_____	$\left( \frac{\sum Q_k^t U_k}{Q_k^0} \right) / \sum U_k$	_____
D	_____	_____	$\left( \frac{\sum P_k^t W_k}{P_k^0} \right) / \sum W_k$

Symbol P: Price series data                      W: Overall weight for price series  
 Q: Quantity series data                      U: Overall weight for quantity series  
 V: Amount series data                      S: Overall weight for amount series  
 O: Base year                      t: Comparison year k: item

**6. Import and export value estimates**

**(1) Nominal values (market value)**

Import and export values are estimated by item of import and export in each row sector. (1) Ordinary trade (imports and exports) and (2) Custom duties (imports) were compiled by reclassifying the Foreign Trade Statistics to the Input-Output Table sector classifications using “Converter Tables Corresponding to HS Code (HS = Harmonized Commodity Description and Coding System) and Input-Output Table Row Sector Classification.” (3) Special trade (imports and exports) and (4) Direct purchases (imports and exports) were divided and compiled based on the divide ratio in the 2005 Basic Tables by relating detailed items in balance of payments tables to the Input-Output Table sector classifications. (5) Adjustment categories (exports) were obtained by multiplying export (ordinary trade) value by indirect export ratio in the base year, as well as consumption tax rate, considering the ratio of export items handled by exporters (indirect export ratio) as being constant. As for (6) Import commodity taxes, liquor tax, tobacco tax, gasoline tax,

local road tax, liquefied petroleum gas tax, and petroleum and coal tax were estimated by the tax amount for customs published by the National Tax Agency. In addition, consumption taxes on imports were estimated by multiplying the sum of the import commodity taxes above, import (ordinary trade), and customs duties by the consumption tax rate.

## (2) Deflator

A price series which sets 2005 as 1 is estimated in each row sector. The adopted series was decided based on the series adopted in the 1995-2000-2005 Linked Input-Output Tables. Specifically, such price series is estimated with the formula below, although it is mainly based on Foreign Trade Statistics (imports and exports statistics) for goods. In sectors except for goods, the domestic production deflator is applied.

$$P_K = \frac{\sum_k v_k}{\sum_k (v_k / p_k)}$$

Notes: P: Deflator      v: Imports and exports values in the target year (Foreign Trade Statistics)  
 p: Growth rate of unit price (Foreign Trade Statistics = Amount/Quantity) compared with 2005  
 K: Row sector item      k: HS item

## (3) Real values (fixed-price value)

Real values were compiled by nominal production values/deflator in each row sector.

## 7. Gross domestic supply value estimates

At the stage when domestic production and import and export values are estimated, gross domestic supply values are calculated by subtracting export values from domestic production in each row sector and adding import values. In addition, the gross domestic supply deflator is also calculated with the formula below.

Gross domestic supply deflator in each row sector =

$$\frac{\text{Market value (Domestic production - Export values + Import values)}}{\text{Fixed-price value (Domestic production - Export values + Import values)}}$$

## 8. Domestic final demand value estimates

Domestic final demand is estimated by row sector as follows, being classified into four categories: (1) Household consumption expenditure, (2) Gross domestic fixed capital formation, (3) Increase in stocks, and (4) Other final demand.

### (1) Estimates of household consumption expenditure

[1] Expenditure amounts in the base year and the target year were calculated by multiplying the expenditure amount by item per household in “Total households” in the “Family Income and Expenditure Survey”—calculated by relating Input-Output Table sector classifications to the

item classifications of Family Income and Expenditure Survey—by the number of households in “Population, demographics, and number of households based on the Basic Resident Register.” Then, the household consumption expenditure was estimated by multiplying the growth rate of these expenditure amounts from the base year to the target year by the household consumption expenditure in 2005 Basic Tables.

- [2] In the sectors where more than 60% of domestic demand was output in the household consumption expenditure in the 2005 Basic Tables, regardless of the estimate method above, the household consumption expenditure was estimated by multiplying the growth rate of gross domestic supply values by row sector from the base year to the target year by the household consumption expenditure in the 2005 Basic Tables.
- [3] Trade margins and freight in the household consumption expenditure were estimated by using the trade margins and freight ratio in the 2005 Basic Tables.

## **(2) Estimates of gross domestic fixed capital formation**

- [1] The fixed capital matrix in the target year was provisionally estimated by multiplying the value of capital goods by capital formation sector in the “Fixed capital matrix” by the growth rate of investment amount by industry in the “Quarterly Financial Statements Statistics of Corporations by Industry,” calculated by relating the industry classifications in the “Quarterly Financial Statements Statistics of Corporations by Industry” to the capital formation sectors in the “Fixed capital matrix (public and private)” in the 2005 Basic Tables. The gross domestic fixed capital formation was estimated by compiling each of these capital goods by public and private sector respectively
- [2] In the sectors where more than 70% of domestic demand was output in the gross domestic fixed capital formation (public and private) in the 2005 Basic Tables, regardless of the estimate method above, the gross domestic fixed capital formation was estimated by multiplying the growth rate of gross domestic supply values by row sector from the base year to the target year by the gross domestic fixed capital formation in the 2005 Basic Tables.
- [3] Trade margins and freight were estimated by using the trade margins and freight ratio in the 2005 Basic Tables.

## **(3) Estimates of increase in stocks**

Increase in stocks of producers’ products was estimated mainly by the Census of Manufactures or the Current Survey of Production, increase in stocks of half-finished goods and work in process mainly by the Census of Manufactures, increase in stocks of distribution mainly by the amount of commodity stocks at the end of term in the Current Survey of Commerce, and increase in stocks of raw materials mainly by multiplying the input ratio of goods by column in 2005 Basic Tables by the amount of increase in stocks of raw materials by industry in the Census of Manufactures, respectively.

#### **(4) Estimates of other final demand**

There are no data for available immediate use regarding consumption expenditure outside households, consumption expenditure of private non-profit institutions serving households, and consumption expenditure of the government other than those listed above, therefore, they were estimated by multiplying each consumption expenditure in the 2005 Basic Tables by the growth rate of gross domestic supply value by row sector from the base year to the target year.

### **9. Estimates in the reuse and recycling sector**

In the reuse and recycling sector, (1) output and input values of scrap and by-products and (2) production values in the reuse and recycling sector are estimated as follows.

#### **(1) Estimates of output and input values of scrap and by-products**

Output and input values of scrap and by-products were estimated by multiplying production values in each sector in the reference year by the output and input ratios of scrap and by-products to the production values in each sector in the 2005 Basic Tables. Input values were mainly adjusted in such a way as to match the absolute values of input values and output values.

#### **(2) Estimates of production values in the reuse and recycling sector**

The expenses of reuse and recycling of scrap and by-products in each sector were calculated by multiplying the input values in the reference year estimated in (1) by the expense rates of reuse and recycling to the input values of scrap and by-products in the base year, and were regarded as the production values in the reuse and recycling sector.

### **10. Input value (intermediate input and value added values) estimate (compilation of trial balance)**

Input value estimate is conducted separately, divided into an intermediate input value estimate and a value-added value estimate. The specific estimate method is as follows. Trial balance in the target year is prepared by this estimate.

#### **(1) Intermediate input values**

Intermediate input values are estimated on the assumption that input coefficients of fixed-price value would be stable (“Stability of input coefficients” in the Input-Output analysis). At first, input coefficients which change prices are calculated by multiplying input coefficients in the 2005 Basic Tables by variations in relative prices in each transaction sector. Then, input values are estimated by multiplying the obtained input coefficients by production values. The estimate formula is as follows.

$$x_{ij}^t = \frac{x_{ij}^0}{X_j^0} \cdot X_j^t \cdot \frac{P_i^t}{P_j^t}$$



Notes: xij: Intermediate input values i: Row sector  
 Xj: Domestic production j: Column sector  
 pi: Domestic production deflator by row sectors 0: Base year  
 pj: Domestic production deflator by column sectors t: Target year

## (2) Gross value-added values

Gross value-added values are calculated by multiplying gross value-added coefficients in the 2005 Basic Tables by domestic production by column sector in the target year except for the mining and manufacturing sector. The estimate formula is as follows.

$$v_{ij}^t = v_{ij}^0 / X_j^0 \cdot X_j^t$$

Notes: vij: Gross value-added values i: Row sector  
 Xj: Domestic production j: Column sector  
 0: Base year t: Target year

In the mining and manufacturing sector, change rates of each coefficient from the base year to the target year are estimated by obtaining gross value-added coefficients, employee compensation coefficients, and capital consumption coefficients based on the Census of Manufactures through reclassifying the data of the Census of Manufactures to the Input-Output Table sector classifications (column).

Each coefficient in the target year was calculated by multiplying gross value-added coefficients, employee compensation coefficients, and capital consumption coefficients in the 2005 Basic Tables by the change rates obtained above. Then, gross value-added values were calculated by multiplying domestic production by column sector in the target year by the obtained coefficients.

## 11. Balance adjustment

### (1) Setting of set values in the final demand and gross value added sectors

Set values by item in the final demand sector and the gross value added sector are set before balance adjustment.

In reference to the results calculated by multiplying the growth rate from 2005 to the target year—calculated by relating each item of gross domestic products in the “Annual Report on National Accounts (Revised)” to the final demand items and the gross value added sector in the Input-Output Tables—by the sum of columns in each sector in the 2005 Basic Tables, the accumulated value obtained by adjustment in (2) was regarded as the set value.

### (2) Balance adjustment

Based on the prepared trial balance, input values and output values were estimated and adjusted by using the values of items pertaining to the input or output of each raw material obtained from production values, imports values, structure statistics, material statistics, etc., and balance adjustment of inputs and outputs was made to the extent possible.

However, since it was difficult to make all adjustments in a short time, input values and output values were adjusted manually until the difference between production values or gross supply was up to plus or minus 100 billion yen and the error rate of 5%, and then, the balance was adjusted mechanically.

However, imports and exports, increase in stocks, scrap and by-products, and reuse and recycling (rows) were excluded from balance adjustment by using the estimated values without any adjustment.

Mechanical balance adjustment is based on the undetermined multiplier, and the calculation method is as follows.

As the mechanical balance adjustment leaves the digits after the decimal point, the figures are rounded up to the nearest whole number, causing the balance to be inaccurate, but final fine adjustment is made manually.

Market value tables (nominal tables) are completed by such adjustment.

[1] Given data

	Intermediate demand sector	Final demand sector	Production
Intermediate input sector	$x_{ij}$	$f_{ij}$	$X_i$
Gross value added sector	$v_{ij}$		$V_i$
Production	$X_j$	$F_j$	

If the Input-Output Table above is given,

$$(R_{ij}) = \begin{pmatrix} x_{ij} & f_{ij} \\ v_{ij} & \end{pmatrix} \quad , \quad (r_i) = \begin{pmatrix} X_i \\ V_i \end{pmatrix} \quad , \quad (s_j) = (X_j \quad F_j)$$

[2] Understanding of problems

In cases where total column set value vector  $(s_j)$  and total row set value vector  $(r_i)$  of the given data are not in accordance with the sum of columns  $\left(\sum_i R_{ij}\right)$  and sum of rows  $\left(\sum_j R_{ij}\right)$  of transaction value data  $(R_{ij})$ , based on the structures of the original data including the input structure, it is a problem how to calculate  $\hat{R}_{ij}$  at less distance from  $R_{ij}$  concerning arbitrary i and j in the formula below.

$$\begin{aligned}
s_j &\neq \sum_i R_{ij} & s_j &= \sum_i \hat{R}_{ij} \\
r_i &\neq \sum_j R_{ij} & r_i &= \sum_j \hat{R}_{ij} & \{(i=1,2,\dots,n), (j=1,2,\dots,m)\}
\end{aligned}$$

[3] Setting of an objective function and constraint condition

Objective function that should be minimized is as follows.

$$2Q = \sum_{i=1}^n \sum_{j=1}^m \left\{ \left( \frac{\hat{R}_{ij}/r_i}{R_{ij}/r_i} - 1 \right)^2 + \left( \frac{\hat{R}_{ij}/s_j}{R_{ij}/s_j} - 1 \right)^2 \right\} \Rightarrow \text{Minimization} \dots\dots\dots \textcircled{1}$$

Change rate of output ratio
Change rate of input ratio

Constraint condition is as follows.

$$\left. \begin{aligned}
\sum_i \hat{R}_{ij} &= s_j && \text{Regarding } j (j=1,2,\dots,m) \\
\sum_j \hat{R}_{ij} &= r_i && \text{Regarding } i (i=1,2,\dots,n)
\end{aligned} \right\} \dots\dots\dots \textcircled{2}$$

## 12. Compilation of fixed-price value tables (real tables)

In each row sector for which final adjustment was made, each transaction value at the market value is divided by the production deflator for domestic production, export deflator for export values, import deflator for import values, or gross domestic supply deflator for domestic demand values, for conversion into that at the fixed-price value.

As for value-added values, realization by item is not conducted, and the sum of total intermediate input values and value-added values at the market value which were realized by column sector was obtained and the difference between domestic production at the fixed-price value (production values in column sectors = production values in row sectors) in the double deflation error sector was recorded.