

### **Appendix 3**

#### **Sampling Establishments, Estimation Method of Results and Sampling Error of the Estimates**

#### **Sampling Establishments**

In this survey, approximately 39,000 establishments that existed when the 2006 Establishment and Enterprise Census of Japan was conducted and are generally categorized in the industries listed below, were selected using a statistical method.

#### **(1) Coverage of the Survey**

The survey covers industries classified in groups designated by the Japan Standard Industrial Classification (Rev.12, November 2007) as shown below.

- Information and communications
- Transport and postal activities
- Real estate and goods rental and leasing
- Scientific research, professional and technical services
- Accommodations, eating and drinking services
- Living-related and personal services and amusement services
- Education, learning support
- Medical, health care and welfare
- Services, n.e.c.

“Electricity, gas, heat supply and water” (which has an overlap with the secondary sector), “Wholesale and retail trade” and “Compound services” (statistical data are already available for these two), “Finance and insurance” (the definition of “sales (income)” is different from other industries), “School education”, “Political, business and cultural organizations”, “Religion” and “Foreign governments and international agencies in Japan” (we consider monthly base data collection to be unnecessary), “Domestic services” (this was not surveyed in the 2006 Establishment and Enterprise Census of Japan), “Public health centers” and “Welfare offices” (public institutions) are excluded from the survey.

(Note) Sample design was performed according to the Japan Standard Industrial Classification (Rev.11, March 2002). Since “Food take out and delivery services” was classified as “Wholesale and retail trade” according to this classification, “Food take out and delivery services” was excluded from the survey.

## **(2) Sampling and Replacing Establishments**

From among 2.81 million establishments engaged in the service sector, a total of approximately 39,000 establishments were selected. Establishments with less than 10 persons working at the location of establishment were selected based on “industry” and “region”, establishments with 10 or more persons working at the location of establishment were selected using “industry” and “establishment size according to the number of persons working at the location of establishment” based stratified sampling methods. In principle, the subject establishments are surveyed for two years while half of the subjects were replaced by new ones every January. This is to retain the reliability of the survey and to improve the accuracy of the survey (e.g. to obtain the corresponding ratio to the previous year). To maintain the accuracy of the survey, the group that is necessary to secure the sample size (approximately 9,000 establishments, hereinafter referred to as the “census survey group”) will not be replaced and will be surveyed every time.

The samples were selected based on a survey conducted in 2006, the Establishment and Enterprise Census of Japan. Establishments which were established after the 2006 Establishment and Enterprise Census of Japan are not included in this survey. If a selected establishment goes out of business, an alternative establishment will be selected for the survey.

### **Estimation Method of Results**

Results are estimated as follow:

#### **(1) Census survey group**

Census survey group is calculated with a weight of 1, and calculates numbers for establishment sales (income), number of persons working at the location of establishment, etc.

#### **(2) Sample survey group**

Sample survey group is calculated with a weight inverse to the number of the sampling ratio in each industry and group of establishment size according to the number of persons working at the location of establishment.

### (3) How to deal with missing values

If missing values occur as a result of failure to collect the questionnaires before the due date, the estimated value of each establishment will be used for calculation.

Estimated values are calculated as follows: If there is no data from the previous month at the beginning of the survey (first month), a regression equation is used. After the second month, the relative change is calculated from the previous month, and then added to the data from the previous month.

- First month of the survey

The estimated values are calculated based on the number of persons working at the location of establishment categorized by industry. The data is used as an explanatory variable based on the logarithm retrogression model.

$$\log(y_i) = \beta_0 + \beta_1 \times \log(x_i)$$

$y_i$  : Sales (Income) at the present month or the number of persons working at the location of establishment at the present month

$x_i$  : The number of persons working at the location of establishment on the census list

However, if the data  $x_i$  or  $y_i$  is 0 person (0 thousand yen) or minus, the applicable establishments are excluded when calculating the regression coefficient  $\beta_0$ ,  $\beta_1$ .

- From the second month of the survey onward

The number of persons working at the location of establishment categorized by industry is divided into four different groups (①Under 10 persons, ②10-29 persons, ③30-99 persons, ④100 persons or more). The average rate of the relative change during the last two months is calculated and then added to the sales (income), or number of persons working at the location of establishment from the previous month. This is how the estimated value of the present month is calculated. The average rate of the relative change is based on a geometric mean. However, if the data from the previous month is 0 person yen (0 thousand) or minus, or the data from the previous month is estimated, the applicable establishments are excluded.

### Sampling Error of the Estimates

Sampling errors for sales (income) are estimated by the following formula. The results can be seen in the table. The estimated values of sampling errors are calculated for each of the four groups divided by the number of persons working at the location of establishment categorized by industry.

The standard error ratio (%) = The standard error of average  $\div$  Average  $\times$  100

$$\text{The standard error of average} = \sigma_{\bar{x}} \approx \sqrt{\frac{1}{N^2} \sum_{i=1}^L N_i(N_i - n_i) \frac{s_i^2}{n_i}}$$

$N$  : The number of population establishments

$N_i$  : The number of population establishments in  $i$  stratum

$n_i$  : The number of sample establishments in  $i$  stratum

$L$  : The number of the stratum

(Size of persons working at the location of establishment)

$s_i^2$  : Sample variance for sales (income) in  $i$  stratum

$$s_i^2 = \frac{1}{n_i - 1} \sum_{j=1}^{n_i} (x_{ij} - \bar{x}_i)^2 = \frac{1}{n_i - 1} \left( \sum_{j=1}^{n_i} x_{ij}^2 - n_i \bar{x}_i^2 \right)$$

$x_{ij}$  : Sales (Income) of  $j$ th sample in  $i$  stratum

$\bar{x}_i$  : Average sample sales (income) in  $i$  stratum

Table Sampling Error for Monthly Sales (Income) of the Estimates by Industry

(%)

Industry (medium groups)	2012											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Service industry	1.2	1.2	1.5	1.3	1.2	1.2	1.4	1.3	1.3	1.3	1.2	1.3
<b>G Information and communications</b>	3.8	3.9	3.7	4.8	4.6	4.4	4.9	5.1	3.9	4.5	4.5	4.7
37 Communications	11.0	11.2	12.7	13.6	12.9	13.5	13.7	14.1	12.7	12.2	12.2	13.5
38 Broadcasting	2.6	3.3	2.4	2.6	2.7	2.7	2.6	2.8	2.6	2.8	2.7	2.5
39 Information services	3.7	3.7	3.1	4.0	3.9	3.4	3.9	4.0	3.0	3.8	3.8	3.8
40 Internet based services	5.4	5.4	5.5	5.2	5.4	5.3	5.2	5.1	5.1	5.2	5.1	4.8
41 Video picture, sound information, character information production and distribution	1.8	1.7	1.9	2.0	1.8	1.8	2.7	1.7	1.6	1.7	1.7	1.6
<b>H Transport and postal activities</b>	3.0	3.1	3.3	2.8	2.9	2.9	2.9	3.0	2.9	3.0	2.9	2.9
42 Railway transport	3.8	3.8	4.1	4.3	4.0	4.0	4.0	3.9	4.4	4.1	3.9	3.9
43 Road passenger transport	2.5	2.4	3.1	3.0	3.2	2.6	2.5	3.7	3.6	4.1	4.5	3.2
44 Road freight transport	4.6	4.6	5.1	4.4	4.8	4.9	4.8	4.9	4.9	4.9	4.9	5.0
45 Water transport	5.8	5.6	5.8	5.4	5.2	5.5	5.4	5.6	6.6	5.4	5.8	5.9
47 Warehousing	12.1	11.7	11.4	8.9	8.7	8.9	8.3	13.0	8.7	8.4	8.8	8.9
48 Services incidental to transport	11.4	11.8	11.9	10.4	10.1	9.8	10.4	10.2	10.1	11.1	10.1	9.8
<b>K Real estate and goods rental and leasing</b>	5.5	4.7	7.7	5.3	5.4	5.3	6.4	6.1	6.2	6.7	5.4	5.4
68 Real estate agencies	8.1	9.7	7.2	11.1	8.6	6.1	13.5	6.9	12.7	14.9	6.8	8.3
69 Real estate lessors and managers	11.1	4.7	12.2	8.5	10.5	10.7	10.9	13.3	11.0	10.7	11.4	10.8
70 Goods rental and leasing	8.6	8.8	18.3	8.4	8.6	9.2	8.9	8.8	8.5	8.7	8.7	8.5
<b>L Scientific research, professional and technical services</b>	3.2	3.2	3.4	4.2	3.4	3.7	3.6	3.4	3.2	3.4	3.2	3.4
71 Scientific and development research institutes	7.8	8.3	6.9	8.4	8.5	8.1	8.9	9.3	8.2	9.3	9.6	8.3
72 Professional services, n.e.c.	5.2	5.2	6.9	5.3	5.3	5.7	5.7	6.2	5.9	5.5	5.2	5.2
73 Advertising	6.9	7.0	7.5	6.6	7.4	7.0	6.7	7.1	7.0	7.7	6.9	8.2
74 Technical services, n.e.c.	5.5	5.2	5.4	7.5	5.8	6.7	6.5	5.6	5.2	5.4	5.4	5.4
<b>M Accommodations, eating and drinking services 1)</b>	1.6	1.7	1.7	1.6	1.6	1.6	1.8	2.0	1.8	1.7	1.7	1.8
75 Accommodations	3.2	3.8	4.0	3.4	3.2	3.4	4.3	4.6	4.0	3.5	3.5	4.0
76 Eating and drinking places	1.9	1.9	1.9	1.8	1.9	1.9	1.9	2.0	1.9	1.9	1.9	2.0
<b>N Living-related and personal services and amusement services</b>	4.3	4.1	4.4	3.8	3.8	3.7	5.0	3.9	4.9	3.7	3.6	3.7
78 Laundry, beauty and bath services	3.4	3.3	3.7	4.1	4.1	3.9	4.6	4.2	4.9	3.9	4.0	4.1
79 Miscellaneous living-related and personal services 2)	6.7	5.8	5.8	5.6	5.8	5.6	6.5	6.8	5.8	5.8	5.8	5.5
80 Services for amusement and hobbies	6.0	6.1	6.5	5.5	5.5	5.5	7.4	5.5	7.2	5.5	5.4	5.6
<b>O Education, learning support 3)</b>	5.1	5.5	6.3	6.0	9.9	7.1	6.1	5.1	5.7	5.4	5.7	6.7
82 Miscellaneous education, learning support	5.1	5.5	6.3	6.0	9.9	7.1	6.1	5.1	5.7	5.4	5.7	6.7
<b>P Medical, health care and welfare</b>	1.9	1.9	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
83 Medical and other health services	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.4	2.4	2.4	2.4
84 Public health and hygiene 4)	9.5	6.8	6.7	7.3	7.0	6.5	6.4	6.9	6.8	6.5	7.0	7.3
85 Social insurance and social welfare 5)	2.7	2.7	2.7	2.9	2.7	2.7	2.8	2.8	2.9	2.8	2.8	2.8
<b>R Services, n.e.c. 6)</b>	2.8	2.5	3.0	2.9	2.7	2.7	2.9	2.8	2.9	2.9	2.7	2.8
88 Waste disposal business	10.9	9.4	11.6	10.6	8.6	8.6	10.7	9.6	11.4	10.7	9.5	9.5
89 Automobile maintenance services	4.4	4.5	4.4	4.3	4.4	4.2	4.4	4.3	4.3	4.3	4.4	4.3
90 Machine, etc. repair services, except otherwise classified	4.9	4.7	7.5	9.5	9.7	8.9	9.4	9.6	8.5	9.7	9.5	9.2
91 Employment and worker dispatching services	8.1	8.0	8.0	7.9	8.0	7.8	7.7	7.6	7.7	7.7	7.7	7.8
92 Miscellaneous business services	3.4	3.1	3.8	3.0	3.0	3.3	3.0	3.0	3.0	2.9	2.9	3.3
95 Miscellaneous services	10.6	10.5	10.2	9.9	10.4	10.8	10.3	10.9	10.6	9.9	10.8	10.6

Note) For the census survey group, variance was calculated as 0.

1) Excluding food take out and delivery services 2) Excluding domestic services 3) Excluding school education 4) Excluding public health centers 5) Excluding welfare offices

6) Excluding political, business and cultural organizations, religion, foreign governments and international agencies in Japan