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March 2, 2007
Research and Statistics Department
Bank of Japan

Regular Revision of the TANKAN Sample Enterprises

1. Outline

The Bank uses a sample survey framework for the TANKAN (Short-term Economic Survey of Enterprises in Japan). It randomly extracts samples from a population (excluding financial institutions) with capital of at least 20 million yen, based on the "Establishment and Enterprise Census of Japan" conducted by the Ministry of Internal Affairs and Communications.

To accurately grasp actual economic conditions, the Bank makes regular revisions to the TANKAN sample enterprises when the Ministry revises the "Establishment and Enterprise Census of Japan[1]."

This March, the Bank has made revisions to the sample enterprises that are based on the most updated population (210,000 enterprises based on the 2004 "Establishment and Enterprise Census of Japan"), after a three-year interval from the last revision.

The sample design for the March 2007 revision has been conducted under the same method as the last revision (the revision of sample enterprises in the March 2004 survey). The Bank has decided to continue using current sample enterprises (note that enterprises with capital of less than 20 million yen have been eliminated). Also, it has added new sample enterprises under certain criteria that have been set to statistical accuracy and other measuring instruments (Figure 1 -- refer to the attachment for details on sample design).

As a result of the revision, the total number of sample enterprises has increased to 11,026. Of the 9,789 enterprises of the December 2006 survey, 150 enterprises have been eliminated, and 1,387 have been newly added.

From the March 2007 survey, the Bank will conduct the survey based on the new sample enterprises[2].

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[1] In the past, the Bank revised sample enterprises once every five years. For the March 2004 survey, while changing the survey framework and other aspects, it searched for a way to reflect the industrial structure of the economy to the TANKAN more rapidly. It decided to adjust the revision frequency to that of the "Establishment and Enterprise Census of Japan" by shortening the frequency to once every two to three years. The March 2007 revision is the first revision conducted under the new policy.

[2] The number of sample enterprises may change in the future due to mergers, spin-offs, and other corporate activity. The regular revision on sample enterprises of financial institutions has also been conducted; their total has changed to 208 (current sample enterprises maintained as sample enterprises: 202, newly added sample enterprises: 6).

Revision of the sample enterprises will produce discontinuity between the figures of the December 2006 survey and those of the March 2007 survey.

The Bank implemented the following measures to check the size of the differences caused by the revision. It conducted a preliminary survey to new sample enterprises of the March 2007 survey on items of the Judgement survey (e.g., "Business Conditions"), and the quantitative survey (e.g., "Sales"). It recalculated the figures of the December 2006 survey based on the preliminary survey.

The comparison between the pre- and post-revision figures of the December 2006 survey showed that, in general, there were only minor differences for both the Judgement survey and Annual projections (Figure 2, "Data Comparison Between Pre- and Post-revision of the TANKAN in the December 2003 Survey" <released on March 2, 2007, Research and Statistics Department, Bank of Japan>).

2. Data Used in Release Materials of the March 2007 Survey (due to be released on April 2 and 3)

As mentioned above, the Bank has calculated figures of the December 2006 survey with both pre- and post-revision sample enterprises. In principle, the Bank plans to use the pre-revision figures in the release materials of the March 2007 survey, and post-revision data as reference figures[3]. However, for comparing figures of the December 2006 and March 2007 surveys, post-revision figures will be adopted for the former survey.

Figures of the December 2006 survey will be used in the release materials of the March 2007 survey (due to be released on April 2 and 3) in the following ways:

"Outline" and "Summary"

In principle, post-revision figures will be used, but pre-revision figures will be adopted for the end of March and June 2006 data of "Ratio of liquidity" and "Number of employees" (Quarterly data).

Graphs of the "Summary"

(1) Long-term Time-series Data

Pre-revision figures of the December 2006 survey will be connected to post-revision figures of the March 2007 survey.

[3] At the March 2004 survey, the Bank made significant revisions to the survey's framework in addition to revision of the sample enterprises, and changed the criterion for the scale of enterprises (large, medium, and small enterprises) from the number of employees to the capital of enterprises. Like the March 2007 revision, the Bank calculated figures of the December 2003 survey under the post-revision basis, but adopted figures of both pre- and post-revision basis for the December 2003 survey data (differences between pre- and post-revision were shown).

(2) Developments of Fixed Investment including Land Purchasing Expenses

For fiscal year 2006, pre- and post-revision figures will not be connected. Instead, the graphs will show two sets of figures: pre-revision figures up to the December 2006 survey, and post-revision figures from that survey.

"Figures by Industry," "The Comprehensive Data Set," and "Long-Term Time-Series Data"

Pre-revision basis will be adopted for figures until the December 2006 survey, and post-revision basis will be used for figures from March 2007 survey[4].

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[4] The same method is used for the "Summary" under the number of employees basis.

Figure1

Number of Population and Sample Enterprises by Industry and Scale - March 2007 Survey

Industry	All Enterprises		Large Enterprises		Medium Enterprises		Small Enterprises	
	Population	Sample	Population	Sample	Population	Sample	Population	Sample
All Industries	**209,358**	**11,026**	**5,388**	**2,480**	**21,205**	**2,962**	**182,765**	**5,584**
Manufacturing	44,538	4,561	2,098	1,252	5,626	1,243	36,814	2,066
Textiles	3,112	258	65	42	227	63	2,820	153
Lumber & Wood Products	1,975	149	29	22	140	35	1,806	92
Pulp & Paper	1,336	161	48	33	162	45	1,126	83
Chemicals	2,030	296	290	152	477	64	1,263	80
Petroleum & Coal Products	207	89	26	21	34	19	147	49
Ceramics, Stone & Clay	3,051	227	91	50	293	57	2,667	120
Iron & Steel	1,145	220	81	53	208	59	856	108
Nonferrous Metals	732	163	65	38	155	57	512	68
Food & Beverages	5,890	490	208	124	700	131	4,982	235
Processed Metals	4,107	296	102	57	354	77	3,651	162
Industrial Machinery	5,876	531	280	168	685	134	4,911	229
Electrical Machinery	5,024	693	395	229	929	212	3,700	252
Shipbuilding, Heavy Machinery, etc.	592	145	42	31	78	39	472	75
Motor Vehicles	1,710	300	161	117	305	88	1,244	95
Precision Machinery	1,169	179	65	39	172	50	932	90
Other Manufacturing	6,582	364	150	76	707	113	5,725	175
Nonmanufacturing	164,820	6,465	3,290	1,228	15,579	1,719	145,951	3,518
Construction	54,691	1,263	291	143	1,539	211	52,861	909
Real Estate	12,506	469	399	81	1,746	146	10,361	242
Wholesaling	33,163	1,156	645	180	3,812	344	28,706	632
Retailing	16,903	798	387	155	1,699	230	14,817	413
Transportation	11,263	654	300	142	1,204	172	9,759	340
Communications	417	100	70	36	102	37	245	27
Information services	5,346	280	228	100	1,291	91	3,827	89
Other Information Communication	2,661	245	263	65	736	97	1,662	83
Electric & Gas utilities	326	145	74	44	136	58	116	43
Services for Businesses	10,099	363	147	71	1,068	97	8,884	195
Services for Individuals	9,380	375	183	79	1,162	75	8,035	221
Restaurants & Accommodations	6,430	329	207	77	869	89	5,354	163
Leasing	1,151	211	63	41	186	61	902	109
Mining	484	77	33	14	29	11	422	52

(Note 1) Large Enterprises: capital of 1 billion yen or more. Medium Enterprises: capital of 100 million yen to less than 1 billion yen. Small Enterprises: capital of 20 million yen to less than 100 million yen.

(Note 2) The number of sample enterprises is based on the December 2006 preliminary survey. It may change in the future due to mergers, spin-offs, and other corporate activity.

Comparison Between Pre- and Post-revision
- Main Items (December 2006 Survey)

Business Conditions (December 2006 Survey) ("Favorable" Minus "Unfavorable," % Points)

		Diffusion Index (Actual)		B-A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	8	10	2
Large Enterprises	Manufacturing	25	25	0
	Nonmanufacturing	22	22	0
Medium Enterprises	Manufacturing	17	21	4
	Nonmanufacturing	4	7	3
Small Enterprises	Manufacturing	10	12	2
	Nonmanufacturing	▲ 6	▲ 4	2

Sales (%, % points)

		Year-to-year Change (fiscal 2006)		B-A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	3.6	3.7	0.1
Large Enterprises	Manufacturing	4.7	5.1	0.4
	Nonmanufacturing	3.5	3.7	0.2
Medium Enterprises	Manufacturing	6.2	5.2	▲ 1.0
	Nonmanufacturing	4.6	5.1	0.5
Small Enterprises	Manufacturing	3.1	3.2	0.1
	Nonmanufacturing	1.4	1.2	▲ 0.2

Current Profits (%, % points)

		Year-to-year Change (fiscal 2006)		B-A
		Pre-revision (A)	Post-revision(B)	
All Enterprises	All Industries	4.7	5.1	0.4
Large Enterprises	Manufacturing	6.6	6.2	▲ 0.4
	Nonmanufacturing	4.4	4.5	0.1
Medium Enterprises	Manufacturing	8.2	8.9	0.7
	Nonmanufacturing	2.3	3.5	1.2
Small Enterprises	Manufacturing	3.0	3.1	0.1
	Nonmanufacturing	1.6	3.6	2.0

Developments of Fixed investment including Land Purchasing Expenses (%, % points)

		Year-to-year Change (fiscal 2006)		B-A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	10.5	10.1	▲ 0.4
Large Enterprises	Manufacturing	16.5	16.1	▲ 0.4
	Nonmanufacturing	10.1	10.3	0.2
Medium Enterprises	Manufacturing	6.9	9.3	2.4
	Nonmanufacturing	10.0	8.4	▲ 1.6
Small Enterprises	Manufacturing	14.0	9.1	▲ 4.9
	Nonmanufacturing	1.9	▲ 0.9	▲ 2.8

Sample Design[1]

The sample survey method is used for the TANKAN. Because this method involves calculating population estimates from samples, it contains errors (sampling errors). Due to this problem, it becomes necessary to create an appropriate sample design to compile highly accurate statistics.

The Bank has two key goals: to achieve high statistical accuracy, and to lessen the burden for responding and compiling the TANKAN.

The sample design for the March 2007 revision has been conducted under the same method as the last revision (the revision of sample enterprises in the March 2004 survey), but it now uses the "2004 Establishment and Enterprise Census of Japan."

1. Setting Statistical Accuracy Targets

For Judgement survey items (e.g., "Business Conditions"), the Bank simply aggregates the answers received from sample enterprises.

As for Quantitative items such as "Sales", "Profits", and "Fixed investment", the Bank uses a different calculating method, as explained further on in this paper. It categorizes the population by strata that have been segmented by "Industry," "Capital," and "Number of employees," and estimates the overall population aggregate by expanding the sample enterprises' answers (the estimated figure is called the "Population estimate").

The Bank sets an accuracy target (error range) for calculating the population estimate. It sets an error range to the population estimate of "Sales" of sample enterprises. Specifically, the Bank has set the error ratio (Appendix 1 -- an index that relatively shows the size of the deviation between the estimated figure of the sample survey and the real figure <the result of the census survey>) for six categories (manufacturing and nonmanufacturing × large, medium, and small enterprises), at less than 3 percent for manufacturing and less than 5 percent[2] for nonmanufacturing[3].

The Bank has also set a nonbinding accuracy target on the error ratio for each industry (30 industries) and scale (large, medium, and small enterprises) at less than approximately 10 percent.

The error ratios for the six categories set as a result of the March 2007 revision on sample enterprises are shown in the table below (Appendix 2 -- detailed information on error ratio by industry and scale).

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[1] For details on sample design, refer to "Sample Design and Sample Maintenance of TANKAN" (June 7, 2004, Research and Statistics Department, Bank of Japan).

[2] Because individual enterprises vary largely overall in the nonmanufacturing industry compared to the manufacturing industry, the target accuracy has also been set with less strictness.

[3] For financial institutions, the Bank has set an error ratio at less than 10 percent to the population estimate of sample enterprises' "Fixed investment", since the TANKAN does not survey "Sales" of financial institutions.

Error Ratio of Sales (Population Estimate)

	Large enterprises	Medium Enterprises	Small Enterprises
Manufacturing	1.3%	2.5%	2.5%
Nonmanufacturing	2.2%	3.7%	3.0%

2. Dividing the Strata and Extracting Samples From Strata

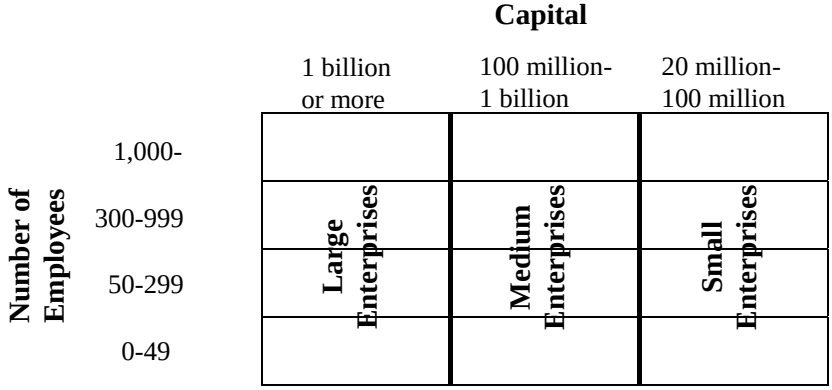
(Designing the Strata)

It is efficient to divide the strata into small segments with similar characteristics for achieving the statistical accuracy target, using as few samples as possible.

For this reason, the strata have been divided by "Industry," "Capital," and "Number of employees." Each "Industry" (30 total) has three strata for "Capital" of sample enterprises (20 million yen to less than 100 million yen, 100 million yen to less than 1 billion yen, and 1 billion yen or more) and four strata for the "Number of employees" of sample enterprises (0-49, 50-299, 300-999, 1,000 or more)

A total of 383 strata[4] have been set through the March 2007 revision.

Design of the Strata



(Note) Each small rectangle, segmented by both the thick and dotted lines, represents a stratum. Scales of enterprises (large, medium, and small enterprises) are further divided by capital (large enterprises: 1 billion yen or more, medium enterprises: 100 million yen to less than 1 billion yen, small enterprises: 20 million yen to less than 100 million yen).

[4] No sample enterprises have been extracted from strata with less than five population enterprises (46 strata in total), since the population estimate for these strata may not be calculated if no response is obtained.

(Extracting Samples from Strata)

For each stratum, the Bank has decided to continue using the current sample enterprises as sample enterprises for the March 2007 survey (sample enterprises with capital of less than 20 million yen have been eliminated). It has also extracted enterprises from the appropriate strata at random[5], to add as new sample enterprises.

Because the TANKAN is a sample survey, in theory it is better to change all sample enterprises at every revision. In practice, this is difficult, since the Bank would have to replace a very large number of sample enterprises. Moreover, maintaining current sample enterprises helps to avoid the decrease in the response rate and the increase of mistakes in the responses by sample enterprises.

3. Testing the Fitness Between Sample Enterprises and Population Enterprises

As mentioned earlier, not all sample enterprises are extracted at random, because the Bank continues to use current sample enterprises.

Unless the Bank takes measures to prevent biased results, sample enterprises of the TANKAN may not represent the population enterprises appropriately (the distribution of sample enterprises may be biased compared to that of the population enterprises).

As a solution, the Bank has tested the fitness of the distribution of sample enterprises from the population enterprises for each stratum, during the revision. When it found adjustment was necessary, the Bank added more sample enterprises.

The specific method taken by the Bank for checking the deviation between distributions was as follows: the Bank divided each stratum into smaller segments ("minimum strata") by "capital" and "number of employees" of the sample enterprises. It then checked the deviation of the distribution of sample enterprises from the distributions of population enterprises by using the Chi-square goodness of fit test (Appendix 1).

[5] The Bank has strived to maintain the ratio for sample extraction (sample enterprises / population enterprises) at more than 1 percent to avoid the case in which an unusual change in figures for one sample enterprise expands and disturbs the population estimate.

1. Definition of Error Ratio

As shown in the formula below, the error ratio is an index showing the deviation of the sample mean from the population mean.

$$Error\ ratio := \frac{(Standard\ deviation\ of\ Sample\ mean)}{Population\ mean}$$

$$Standard\ deviation\ of\ Sample\ mean := \sqrt{\sum_{i=1}^{L} W_i^2 \frac{N_i - n_i}{N_i - 1} \frac{\sigma_i^2}{n_i}}$$

$$Population\ mean := \sum_{i=1}^{L} W_i \ \overline{Y_i}$$

$$\begin{cases} N_i : number\ of\ population\ enterprises\ in\ stratum\ i \\ n_i : number\ of\ sample\ enterprises\ in\ stratum\ i \\ \overline{Y_i} : population\ mean\ (of\ Sales)\ in\ stratum\ i \\ \sigma_i^2 : population\ variance\ (of\ Sales)\ in\ stratum\ i \\ W_i : ratio\ of\ N_i\ to\ number\ of\ population\ (*) \\ L : number\ of\ strata\ in\ population\ (*) \end{cases}$$

2. Chi-square Goodness of Fit Test

Chi-square goodness of fit test is a method that checks the significance of the deviation between two distributions. For the TANKAN, the Bank compares the distributions of population enterprises and sample enterprises for each stratum, and tests the null hypothesis that states “the population distribution and the sample distribution are identical.”

Below are the details of the checking procedure:

(1) Subdivide a stratum into several “minimum strata” $(i = 1, 2, \cdots, j)$ by “capital” and “number of employees” of sample enterprises.

(2) Calculate the number of population enterprises $(N_1, N_2, \cdots, N_j)$ and sample enterprises $(n_1, n_2, \cdots, n_j)$ for each minimum stratum.

(3) Calculate the composition ratio of population enterprises in each minimum stratum: $(p_i = \frac{N_i}{N}, N \equiv \sum_{k=1}^{j} N_k)$.

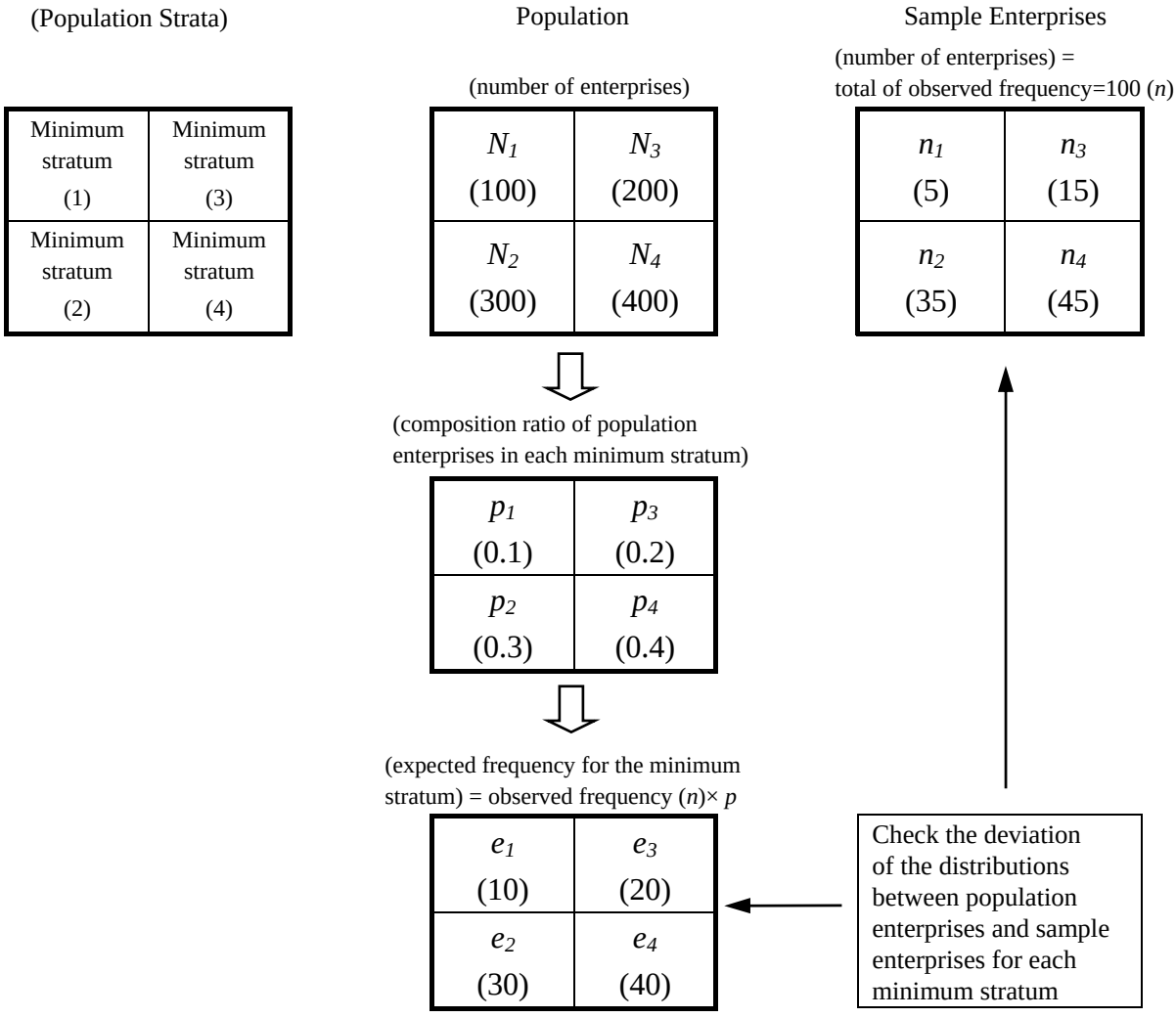
(4) According to the null hypothesis, “the population distribution and the sample distribution are identical.” If this is true, the expected number of sample

enterprises would be: $e_i = n \cdot p_i \quad (n = \sum_{k=1}^{j} n_k)$. Here, n_i is the observed frequency for i, and e_i is the expected frequency for the minimum stratum i. The Chi-square goodness of fit test is conducted under the above conditions.

(5) The null hypothesis ("the shapes of the population distribution and the sample distribution are identical.") is tested using the Chi-square goodness of fit test. The upper limit for failure of the test is 5 percent for each side.

Testing the Fitness of the Distributions

(image diagram; figures are examples)



Error Ratio by Industry and Scale

Industry	Large Enterprises	Medium Enterprises	Small Enterprises
Manufacturing	1.3%	2.5%	2.5%
Textiles	7.0%	9.0%	8.6%
Lumber & Wood Products	7.3%	11.1%	9.9%
Pulp & Paper	2.0%	7.1%	9.1%
Chemicals	5.1%	7.4%	10.4%
Petroleum & Coal Products	1.4%	8.1%	11.3%
Ceramics, Stone & Clay	3.6%	8.8%	8.5%
Iron & Steel	6.5%	9.8%	11.5%
Nonferrous Metals	6.0%	8.2%	11.2%
Food & Beverages	5.5%	7.4%	6.8%
Processed Metals	4.5%	7.2%	7.5%
Industrial Machinery	5.5%	6.0%	8.3%
Electrical Machinery	2.9%	7.8%	9.1%
Shipbuilding, Heavy Machinery, etc.	7.2%	12.6%	10.0%
Motor Vehicles	2.1%	7.8%	8.0%
Precision Machinery	5.1%	8.4%	7.6%
Other Manufacturing	6.3%	6.3%	6.4%
Nonmanufacturing	2.2%	3.7%	3.0%
Construction	6.0%	4.3%	4.4%
Real Estate	8.0%	10.0%	12.3%
Wholesaling	5.3%	8.2%	7.5%
Retailing	7.0%	11.6%	8.1%
Transportation	3.8%	6.9%	5.5%
Communications	12.3%	13.7%	12.1%
Information Services	10.5%	8.6%	9.6%
Other Information Communication	6.6%	10.4%	9.3%
Electric & Gas Utilities	0.8%	9.5%	8.2%
Services for Businesses	6.1%	11.8%	8.6%
Services for Individuals	10.2%	12.0%	11.6%
Restaurants & Accommodations	7.7%	10.5%	6.3%
Leasing	7.5%	11.1%	9.6%
Mining	17.4%	9.9%	23.6%

(Reference) Survey on Financial Institutions

Sectors	Population	Sample Enterprises	Error Ratio
Total for Financial Institutions	743	208	2.8%
Banks	149	76	—
Shinkin Banks, Other Financial Institutions for Small Businesses	281	34	—
Securities Companies	220	27	—
Insurance Companies	59	47	—
Non-deposit Money Corporations	34	24	—