

March 2, 2010  
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 grasp actual economic conditions accurately, the Bank makes regular revisions to the *Tankan* sample enterprises when the Ministry updates the "*Establishment and Enterprise Census of Japan*." Today, the Bank made revisions to the sample enterprises that are based on the most updated population (the total number of 210,000 enterprises based on the "*2006 Establishment and Enterprise Census of Japan*"). The sampling design for the March 2010 revision is the same method as the last revision, that is the revision of sample enterprises in the March 2007 survey. The Bank has decided to continue using current sample enterprises, although the enterprises with capital of less than 20 million yen were eliminated. It also added new sample enterprises under certain criteria related to statistical accuracy and other measuring factors (Figure 1 and the attachment for details on sampling design).

In addition, some industry classifications of the *Tankan* were revised subject to the revision of the "*Japan Standard Industrial Classification*" released in November 2007 (Figure 2).<sup>1</sup>

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<sup>1</sup> For details of the revision of the industry classification, refer to "Revision of the Industry Classification of the Short-term Economic Survey of Enterprises in Japan (TANKAN survey)" (June 30, 2008, Research and Statistics Department, Bank of Japan).

As a result of the revision, the total number of sample enterprises has increased to 11,684, compared with 10,116 enterprises of the December 2009 survey. 98 enterprises have been eliminated and 1,666 newly added<sup>2</sup>.

Starting from the March 2010 survey, the Bank will conduct the *Tankan* survey based on these new sample enterprises. The revision of the sample enterprises will induce discontinuity between the figures of the December 2009 survey and those of the March 2010 survey. Therefore, the Bank conducted a preliminary survey at December 2009 to measure the size of such differences caused by the revision. It covered the same sample enterprises scheduled for the March 2010 survey. The Bank recalculated the figures for the judgement survey such as "Business Conditions" and the quantitative survey such as "Sales" in this preliminary survey basis.

The comparison between the pre- and post-revision figures for the December 2009 survey showed that there were only minor differences for both the judgement survey and annual projections in general (Figure 3 and "Data Comparison Between Pre- and Post-revision of the *Tankan* in the December 2009 Survey" released on March 2, 2010, Research and Statistics Department).

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<sup>2</sup> The number of sample enterprises may change in the future due to mergers, spin-offs, and other corporate activities. The regular revision on sample enterprises of financial institutions has also been implemented. The total institutions have changed to 208; current sample enterprises are 204, newly added sample enterprises are 4 (Appendix 2).

## **2. Release data of the March 2010 Survey (Figures scheduled to be released on April 1 and 2)**

As mentioned above, there are two tiny difference data sets for the December 2009 survey. The Bank designated the post-revision data as reference figures. For comparison between the December 2009 and March 2010 surveys, the post-revision figures for the December 2009 survey will be adopted.

In "Summary," "Figures by Industry," and "The Comprehensive Data Set," the data for individual industry will be calculated by the post-revision industry classifications. In "BOJ Time-Series Data Search," the data will be released not only by the post-revision industry classifications, but also by the old industry classifications. These are Industrial machinery, Precision machinery, Construction & Real estate, Services, which have been already released until the December 2009 survey.

For convenience, the figures in the December 2009 survey will be cited in the release materials of the March 2010 survey, which will be scheduled to be released on April 1 and 2, in the following ways:

Release materials		Data	Industry Classification
"Outline"		In principle, the post-revision figures will be cited, but the pre-revision figures will be referred for the end of March and June 2009 data of "Ratio of liquidity" and "Number of employees" (quarterly data).	-
"Summary"	Tables		Only the post-revision classifications will be adopted.
	Graphs	Long-term Time-series Data	-
		Developments of Fixed Investment including Land Purchasing Expenses	-
"Figures by Industry"		The pre-revision figures will be included until the December 2009 survey, and the post-revision figures from March 2010 survey.	Only the post-revision classifications will be adopted.
"The Comprehensive Data Set"			
"BOJ Time-Series Data Search"			Not only the post-revision classifications but the old classifications will be adopted.

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Figure 1

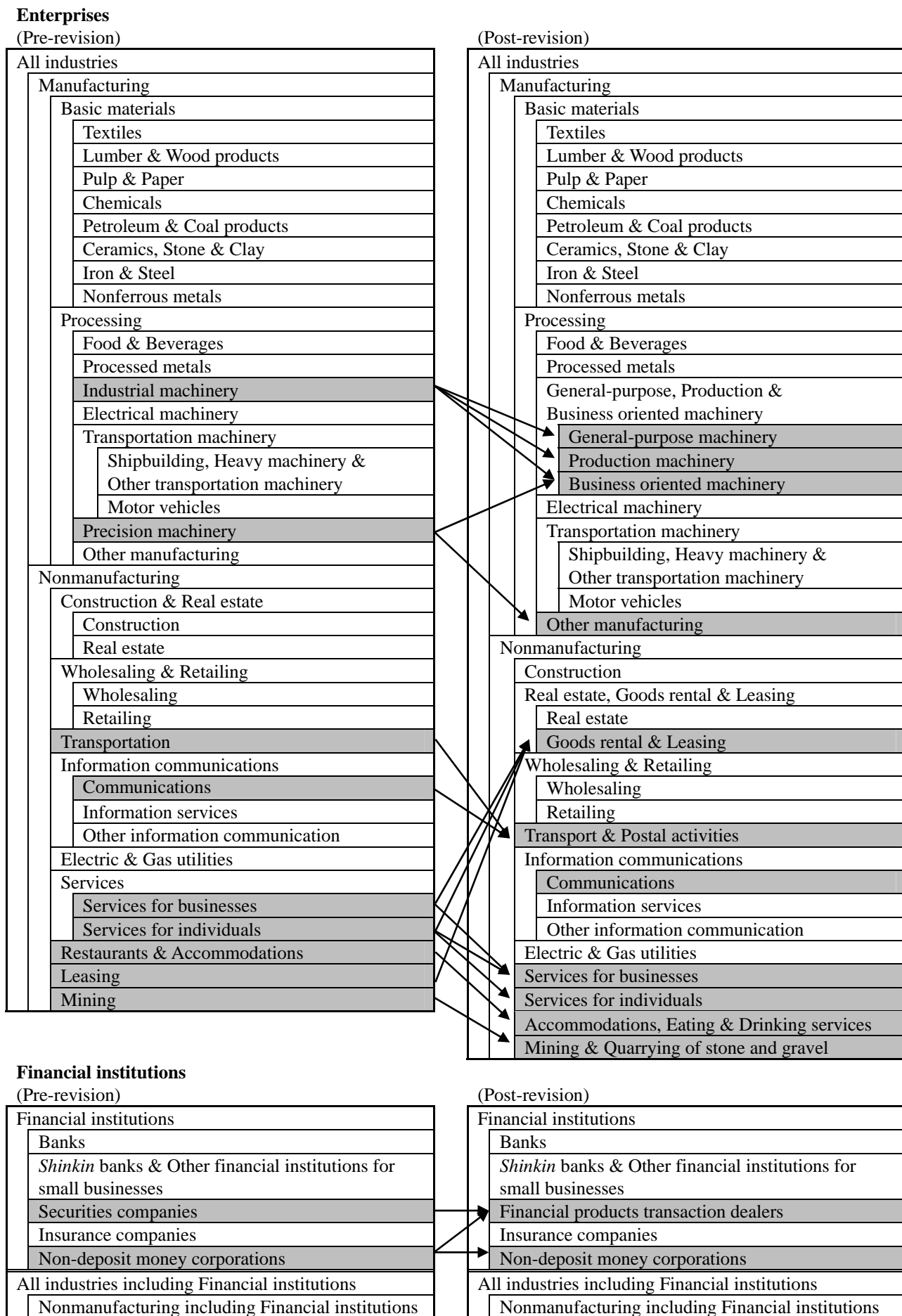
**The Number of Population and Sample Enterprises  
by Industry and Size - March 2010 Survey**

Industry	All Enterprises		Large Enterprises		Medium-sized Enterprises		Small Enterprises	
	Population	Sample	Population	Sample	Population	Sample	Population	Sample
<b>All Industries</b>	<b>213,210</b>	<b>11,684</b>	<b>5,387</b>	<b>2,438</b>	<b>21,554</b>	<b>3,135</b>	<b>186,269</b>	<b>6,111</b>
<b>Manufacturing</b>	<b>44,525</b>	<b>4,613</b>	<b>2,137</b>	<b>1,222</b>	<b>5,674</b>	<b>1,228</b>	<b>36,714</b>	<b>2,163</b>
Textiles	2,921	252	58	40	235	64	2,628	148
Lumber & Wood products	1,874	155	30	23	130	42	1,714	90
Pulp & Paper	1,297	156	49	36	150	43	1,098	77
Chemicals	2,085	333	311	147	506	89	1,268	97
Petroleum & Coal products	217	104	26	18	30	17	161	69
Ceramics, Stone & Clay	2,922	206	87	48	285	55	2,550	103
Iron & Steel	1,160	225	83	52	219	58	858	115
Nonferrous metals	727	215	61	38	156	63	510	114
Food & Beverages	6,025	480	221	121	720	129	5,084	230
Processed metals	4,074	282	102	52	337	75	3,635	155
General-purpose machinery	2,270	197	99	52	262	52	1,909	93
Production machinery	3,374	341	154	96	392	71	2,828	174
Business oriented machinery	1,509	194	95	51	220	55	1,194	88
Electrical machinery	5,012	657	407	225	929	187	3,676	245
Shipbuilding, Heavy machinery & Other transportation machinery	592	156	37	32	77	36	478	88
Motor vehicles	1,717	287	158	114	303	84	1,256	89
Other manufacturing	6,749	373	159	77	723	108	5,867	188
<b>Nonmanufacturing</b>	<b>168,685</b>	<b>7,071</b>	<b>3,250</b>	<b>1,216</b>	<b>15,880</b>	<b>1,907</b>	<b>149,555</b>	<b>3,948</b>
Construction	54,221	1,308	275	130	1,448	194	52,498	984
Real estate	13,462	453	377	87	1,874	132	11,211	234
Goods rental & Leasing	1,812	238	62	36	249	77	1,501	125
Wholesaling	33,642	1,307	684	182	3,968	382	28,990	743
Retailing	16,993	781	368	173	1,485	205	15,140	403
Transport & Postal activities	11,514	693	304	153	1,183	212	10,027	328
Communications	444	99	59	27	119	30	266	42
Information services	5,978	319	234	105	1,419	93	4,325	121
Other information communication	3,096	254	283	61	882	115	1,931	78
Electric & Gas utilities	359	182	79	43	159	97	121	42
Services for businesses	12,236	641	166	64	1,237	138	10,833	439
Services for individuals	8,005	378	153	75	1,045	88	6,807	215
Accommodation, Eating & Drinking services	6,460	350	175	69	775	132	5,510	149
Mining & Quarrying of stone and gravel	463	68	31	11	37	12	395	45

(Note 1) Large Enterprises with capital of 1 billion yen or more. Medium-sized Enterprises with capital of 100 million yen or more and less than 1 billion yen. Small Enterprises with capital of 20 million yen or more and less than 100 million yen.

(Note 2) The number of sample enterprises is based on the December 2009 preliminary survey. It may change in the future due to mergers, spin-offs, and other corporate activity.

## Industry Classifications of the Pre- and Post- Revision



**Comparison Between the Pre- and Post-revision:  
Main Results in the Preliminary Survey Conducted on December 2009 Survey**

Business Conditions (December 2009 Survey)		("Favorable" minus "Unfavorable," % Points)		
		Diffusion Index (Actual)		B - A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	▲ 32	▲ 31	1
Large Enterprises	Manufacturing	▲ 24	▲ 25	▲ 1
	Nonmanufacturing	▲ 22	▲ 21	1
Medium-sized Enterprises	Manufacturing	▲ 30	▲ 28	2
	Nonmanufacturing	▲ 29	▲ 27	2
Small Enterprises	Manufacturing	▲ 40	▲ 41	▲ 1
	Nonmanufacturing	▲ 35	▲ 34	1

Sales		(% , % points)		
		Year-to-year Percent Change (fiscal 2009)		B - A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	▲ 11.4	▲ 11.6	▲ 0.2
Large Enterprises	Manufacturing	▲ 14.5	▲ 14.6	▲ 0.1
	Nonmanufacturing	▲ 11.8	▲ 11.9	▲ 0.1
Medium-sized Enterprises	Manufacturing	▲ 13.6	▲ 14.2	▲ 0.6
	Nonmanufacturing	▲ 7.6	▲ 8.2	▲ 0.6
Small Enterprises	Manufacturing	▲ 15.0	▲ 14.2	0.8
	Nonmanufacturing	▲ 8.5	▲ 8.7	▲ 0.2

Current Profits		(% , % points)		
		Year-to-year Percent Change (fiscal 2009)		B - A
		Pre-revision (A)	Post-revision(B)	
All Enterprises	All Industries	▲ 16.1	▲ 16.9	▲ 0.8
Large Enterprises	Manufacturing	▲ 34.7	▲ 34.6	0.1
	Nonmanufacturing	▲ 10.5	▲ 10.9	▲ 0.4
Medium-sized Enterprises	Manufacturing	▲ 26.7	▲ 33.2	▲ 6.5
	Nonmanufacturing	2.5	▲ 2.7	▲ 5.2
Small Enterprises	Manufacturing	▲ 35.1	▲ 32.3	2.8
	Nonmanufacturing	▲ 7.2	▲ 6.5	0.7

Fixed Investment including Land Purchasing Expenses		(% , % points)		
		Year-to-year Percent Change (fiscal 2009)		B - A
		Pre-revision (A)	Post-revision (B)	
All Enterprises	All Industries	▲ 18.8	▲ 17.5	1.3
Large Enterprises	Manufacturing	▲ 28.2	▲ 28.4	▲ 0.2
	Nonmanufacturing	▲ 5.5	▲ 4.4	1.1
Medium-sized Enterprises	Manufacturing	▲ 33.4	▲ 33.4	0.0
	Nonmanufacturing	▲ 25.7	▲ 23.5	2.2
Small Enterprises	Manufacturing	▲ 39.1	▲ 34.4	4.7
	Nonmanufacturing	▲ 26.4	▲ 26.4	0.0

Note: The pre-revision figures are the same as the official data released on December 14, 2009.

## Sampling Design<sup>1</sup>

The sampling survey method is adopted for the *Tankan*. Since this method calculates population estimates out of samples, it contains estimation errors or sampling errors. In order to obtain highly accurate statistics, we have to prepare an appropriate sampling design.

The Bank pursues two key goals: One is to achieve high statistical accuracy, and the other to lessen the burden of responding and compiling the *Tankan*.

The sampling design for the March 2010 revision is the same method as the last revision, that is the revision of sample enterprises in the March 2007 survey. The present revision adopted the "2006 Establishment and Enterprise Census of Japan" as the population enterprises.

### 1. Setting statistical accuracy targets

For judgement survey items such as "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 adopts a different calculating method, as follows. It categorizes the population by strata that have been segmented by "industry," "capital," and "the number of employees." The Bank estimates the overall population aggregate by expanding the answers of sample enterprises. The estimated figure is equivalent to the "population estimate" under the preposition of the unbiasedness of sample sets.

The Bank sets an accuracy target of error range for calculating the population estimate. It sets an error range to the population estimate of "Sales" of sample enterprises. The error ratios, shown in Appendix 1, the relative size of the deviation between the estimated figure

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<sup>1</sup> For details on sampling design, refer to "Sample Design and Sample Maintenance of TANKAN" (June 7, 2004, Research and Statistics Department, Bank of Japan).



of the sample survey and the population figure of census for six categories (manufacturing and nonmanufacturing for large-, medium-, and small-sized enterprises) are at less than 3 percent for manufacturing and less than 5 percent<sup>2</sup> for nonmanufacturing<sup>3</sup>. The Bank also sets a nonbinding but target error ratio for 31 industries and for large-, medium-, and small-sized enterprises at almost less than 10 percent.

The error ratios for the six categories as a result of the March 2010 revision are shown in the table below (Appendix 2).

Error Ratio of Sales (Population Estimate)

	Large Enterprises	Medium-sized Enterprises	Small Enterprises
Manufacturing	1.5%	2.6%	2.3%
Nonmanufacturing	3.1%	4.3%	3.8%

## 2. Dividing the strata and extracting samples from the strata

(Designing the Strata)

It is smart to divide the strata into smaller segments with similar characteristics for achieving the statistical accuracy target. The segmentation contributes to reduce the number of samples.

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<sup>2</sup> In nonmanufacturing sector, individual enterprises tend to diversify compared to manufacturing, the target accuracy may be set with less strictness.

<sup>3</sup> For financial institutions, the Bank sets the error ratio at less than 10 percent to the population estimate of sample institutions' "Fixed investment," since the *Tankan* does not survey "Sales" for financial institutions.

For this reason, the strata have been divided by "industry," "capital," and "the number of employees." Every "industry" has three strata for "capital" of sample enterprises with 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<sup>4</sup> for "the number of employees" of sample enterprises.

A total of 397 strata<sup>5</sup> will be adopted in the March 2010 revision.

### Design of the Strata

		Capital		
		1 billion or more	100 million-1 billion	20 million-100 million
Number of Employees	Large Enterprises			
	Medium-sized Enterprises			
Small Enterprises				

(Note) Each small rectangle, segmented by both the thick and dotted lines, represents a stratum.

### (Extracting Samples from Strata)

For each stratum, the Bank decided to continue using the current sample enterprises as a part of the revised sample enterprises for the March 2010 survey. Only the sample enterprises with capital of less than 20 million yen have been eliminated. It also

<sup>4</sup> Before the present revision, the strata for the "number of employees" were divided by "0-49 employees, 50-299 employees, 300-999 employees, 1,000 employees and over." At the present revision, the strata were set as for minimizing sample variance.

<sup>5</sup> No sample enterprise has been extracted from the stratum with less than five population enterprises (49 strata in total), since the population estimate for such a stratum may not be calculated if no response is obtained.

extracted additional enterprises for the appropriate strata by random sampling<sup>6</sup>, in order to fulfill the required number for the revised sample enterprises.

In strictly theoretical argument, a sample survey should be changed all samples at every revision. However, in practice, it is not feasible to replace a very large number of sample enterprises at once. In addition, maintaining current sample enterprises helps to avoid the decrease in response rate and the increase of unintentional mistakes in the responses.

### **3. Testing fitness between sample enterprises and population enterprises**

Sample enterprises of the *Tankan* may not represent the population enterprises with unbiasedness due to incomplete random sampling. In order to overcome this issue, the Bank tested the fitness of the revised distribution of sample enterprises from the population enterprises for each stratum.

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

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<sup>6</sup> The Bank maintained almost always the ratio for sample extraction to population enterprises at more than 1 percent to avoid the case in which an unusual change in figures due to one irregular sample 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.

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

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

$$\text{Population mean} := \sum_{i=1}^L W_i \bar{Y}_i$$

$$\left\{ \begin{array}{l} N_i : \text{number of population enterprises in stratum } i \\ n_i : \text{number of sample enterprises in stratum } i \\ \bar{Y}_i : \text{population mean (of Sales) in stratum } i \\ \sigma_i^2 : \text{population variance (of Sales) in stratum } i \\ W_i : \text{ratio of } N_i \text{ to number of population } (*) \\ L : \text{number of strata in population } (*) \end{array} \right.$$

## 2. Chi-square goodness of fit test

Chi-square goodness of fit test is a method that examines 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."

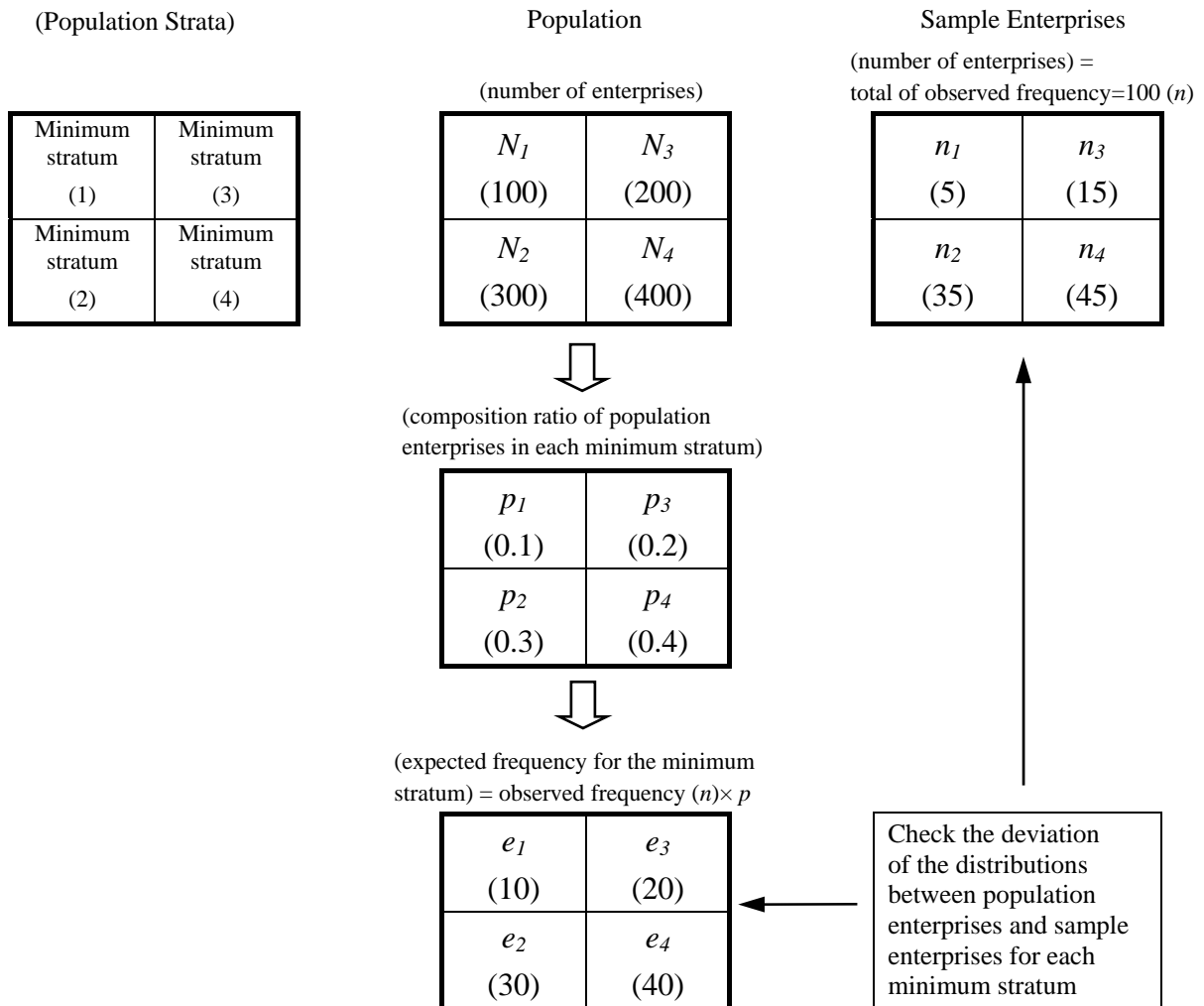
The details of the checking procedure:

- (1) Subdivide a stratum into several "minimum strata" ( $i = 1, 2, \dots, j$ ) by "capital" and "the number of employees" of sample enterprises.
- (2) Calculate the number of population enterprises ( $N_1, N_2, \dots, N_j$ ) and sample enterprises ( $n_1, n_2, \dots, n_j$ ) 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 hypothesis is true, the expected number of sample enterprises would be  $e_i = n \cdot p_i$  ( $n = \sum_{k=1}^j n_k$ ). 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, that is the population distribution and the sample distribution are identical, is tested by applying the Chi-square goodness of fit test. The upper limit for failure of the test is 5 percent for both side.

### Testing the Fitness of the Distributions (Image diagram, example figures)



## Error Ratio by Industry and Scale

Industry	Large Enterprises	Medium-sized Enterprises	Small Enterprises
<b>Manufacturing</b>	<b>1.5%</b>	<b>2.6%</b>	<b>2.3%</b>
Textiles	8.1%	6.9%	7.3%
Lumber & Wood products	5.7%	8.2%	10.1%
Pulp & Paper	5.2%	8.4%	9.9%
Chemicals	6.0%	6.3%	9.8%
Petroleum & Coal products	4.1%	7.3%	11.5%
Ceramics, Stone & Clay	5.4%	8.8%	9.3%
Iron & Steel	6.8%	9.0%	10.1%
Nonferrous metals	8.4%	9.2%	10.2%
Food & Beverages	5.7%	7.7%	6.2%
Processed metals	6.2%	9.6%	7.4%
General-purpose machinery	10.4%	9.8%	7.1%
Production machinery	4.8%	7.5%	5.5%
Business oriented machinery	8.4%	9.9%	9.4%
Electrical machinery	3.6%	7.9%	9.0%
Shipbuilding, Heavy machinery & Other transportation machinery	8.4%	9.4%	11.2%
Motor vehicles	2.6%	9.5%	7.9%
Other manufacturing	8.1%	7.7%	6.8%
<b>Nonmanufacturing</b>	<b>3.1%</b>	<b>4.3%</b>	<b>3.8%</b>
Construction	5.9%	4.2%	2.8%
Real estate	8.8%	8.3%	9.2%
Goods rental & Leasing	11.0%	9.2%	9.1%
Wholesaling	7.4%	9.5%	10.0%
Retailing	2.6%	6.0%	5.0%
Transport & Postal activities	9.5%	9.5%	4.9%
Communications	8.2%	8.5%	12.0%
Information services	9.6%	9.8%	9.6%
Other information communication	7.3%	7.7%	10.2%
Electric & Gas utilities	1.0%	8.4%	9.9%
Services for businesses	6.8%	10.2%	10.0%
Services for individuals	11.2%	8.9%	11.3%
Accommodations, Eating & Drinking services	7.9%	9.2%	6.6%
Mining & Quarrying of stone and gravel	15.5%	18.8%	8.3%

## (Reference) Financial Institutions

Sectors	Population	Sample Enterprises	Error Ratio
<b>Financial Institutions</b>	735	208	<b>3.8%</b>
Banks	143	75	—
<i>Shinkin</i> Banks, Other financial institutions for small businesses	270	36	—
Financial products transaction dealers	231	32	—
Insurance companies	62	47	—
Non-deposit money corporations	29	18	—