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The Stability of Market Leadership Positions in Japanese Manufacturing Industries

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Abstract

Using a newly constructed panel data set, we investigate the stability of market leadership positions as a measure of market mobility. This paper not only shows the extent of stability of leadership positions across industries over time, but also empirically examines the impacts of industry-specific characteristics and macro-economic conditions on the stability of leadership positions. It is found that leadership positions are more stable in highly concentrated industries. In addition, this paper provides evidence that leadership positions are sensitive to macro-economic conditions, and that high economic growth tend to induce the turnover of market leaders.

Keywords: Binary choice model; Concentration; Market leadership position; Panel data.

JEL Classification: L13, L60

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1. Introduction

Market leadership positions are stable over a long period of time in some industries, while the positions are instable in others. What causes the difference in stability of market leadership positions among industries?

This paper explores the stability of market leadership positions as a measure of market mobility. Using a newly constructed panel data set, we show the extent of stability of leadership positions across industries over time, and empirically examine the impacts of industry-specific characteristics and macro-economic conditions on the stability of leadership positions. We employ data in the Japanese manufacturing industry over the period 1977 to 2001, and attempt to identify significant changes in the process of dynamic competition. Our long-term sample unlike previous studies, it is expected, will provide important evidence to assess the competitive process in industries over business cycles.

As Geroski and Toker (1996, p.141) noted, many managers are concerned with their firms' rank at the top of the markets they operate in. Obtaining or sustaining the leadership positions may be a key managerial objective in order to exploit market power and to gain the competitive advantage in the markets. Moreover, as Geroski and Toker pointed out, the turnover of market leaders provides some useful information on the dynamics of the competitive process more accurately than static measures of competition. Until now, some empirical studies have devoted to examining the turnover measure based on firms' positions in industries in order to capture market mobility as a reflection of competition. For example, Joskow (1960) proposed the turnover measure by means of the rank correlation coefficient. In addition, Mueller (1986) and Kambhampati (2000) examined the stability of market leadership positions using a binary choice model, respectively.[1]

On the other hand, some empirical studies (e.g., Caves and Porter, 1978; Sakakibara and Porter, 2001) have used the stability of market shares as a measure of market mobility. This measure that is a continuous variable needs data on changes in top-ranked firms' market shares between two points of time. However, if a top-ranked firm falls substantially from the top position or exits from the market, the firm is sometimes subject to disappearing in the data source at the following year and the measure based on changes in top-ranked firms' market shares cannot be calculated. Thus, the sample size is considerably reduced, particularly when we construct balanced long-term panel data in order to control the possible existence of unobservable industry-specific characteristics.[2] By contrast, the turnover measure based on top-ranked firms' positions allows us to obtain larger sample size over a long period

[1]In previous empirical studies, market mobility has been investigated as the intensity of competition by using several types of measures: for example, changes in market concentration (e.g., Mueller and Hamm, 1974), market share instability (e.g., Caves and Porter, 1978; Sakakibara and Porter, 2001) and the extent of entry and exit (e.g.,Geroski and Schwalbach, 1991). Also, Competition Policy Research Center (2004) and Izumida *et al.* (2004) attempted various researches on market mobility in Japan, by using unpublished data that comes from the Fair Trade Commission of Japan. For more discussion on market mobility, see, for example, Baldwin (1998) and Caves (1998).

[2]In addition, in the case of this measure, it is unclear whether to use the absolute value or the relative value. For more details on this problem, see Caves and Porter (1978) and Sakakibara and Porter (2001).

of time, since we simply compare the identities of top-ranked firms from year to year. Using the measure based on firms' positions, in this paper, we examine the leadership stability over a long period of time in Japanese manufacturing industries.

The plan of this paper is as follows. Section 2 describes data used in this paper. Section 3 shows the extent of stability of market leadership positions across industries over time, and presents an empirical model for the determinants of stability of leadership positions. Section 4 shows empirical results. Finally, we conclude our findings.

2. Data

This section describes data used in this paper. We constructed a new panel data set in Japanese manufacturing industries over the period 1977 to 2001. As a data source, the *Market Share in Japan* (*Nihon Market Shea Jiten*) is used to collect data on market shares and industry concentration.[3] The *Market Share in Japan* has been annually published since 1973 by a Japanese marketing research company, Yano Research Institute Ltd.[4] With respect to industry's shipments, the *Report by Commodity* of the *Census of Manufactures*, which

[3]There are some data sources regarding market shares in Japan: for example, the *Statistics Monthly* (*Tokei Geppo*) by Toyo Keizai Inc. and the *Handbook of Market Shares* by Nihon Keizai Shimbun Inc. Since the number of industries over time in the *Market Share in Japan* is larger than in the others, we here use as a data source the *Market Share in Japan*.

[4]In the *Market Share in Japan*, the measurement units of market shares are different among industries. One is measured by unit volume, and another is measure by the value of shipments or sales. Here, we simply calculate market shares without being converted into unit volume because of the lack of appropriate deflators.

are compiled by the Research and Statistics Department, Economic and Industry Policy Bureau, the Ministry of Economy, Trade and Industry, is used as another data source.

There are, however, several measurement problems to be discussed. First, the industrial classification in the *Market Share in Japan* is not necessarily consistent in each year; that is, some categories have been changed or eliminated. Thus, if we cannot constantly obtain data on market shares in an industry during the observation period, then the industry is excluded from the sample. Then, mergers and acquisitions (M&A) or spin-offs arise during the period in several industries. The industries in which the market shares of top-ranked firms are changed by means of M&A or spin-offs are also excluded from the sample. In addition, we match data on market shares to the six-digit standard industrial classification (SIC), corresponding to the categories used in the *Report by Commodity* of the *Census of Manufactures.* The industries in which data are not available at the six-digit SIC level are also excluded from the sample.

While the *Census of Manufactures* covers all establishments until 1976, it covers only establishments with four or more employees in 1977 and afterwards. Therefore, our sample is restricted to the period of 1977 to 2001. As a result, our panel data set consists of 60 manufacturing industries during 24 years. The industries in the sample are shown in Appendix.

3. Model

We explain our empirical model to estimate the determinants of stability of market leadership positions. In order to measure the stability of leadership positions, three variables are presented in this paper. Let $STAB1$, $STAB2$ and $STAB3$ denote dummies for the stability of positions of the first-ranked firm, the two top-ranked firms and the three top-ranked firms in an industry, respectively. These variables are defined as follows:

$$STAB1 = \begin{cases} 1 & \text{if} \quad \#1 \longrightarrow \#1 \\ 0 & \text{otherwise} \end{cases}$$

$$STAB2 = \begin{cases} 1 & \text{if} \quad \#1 \longrightarrow \#1 \quad \text{and} \quad \#2 \longrightarrow \#2 \\ 0 & \text{otherwise} \end{cases}$$

$$STAB3 = \begin{cases} 1 & \text{if} \quad \#1 \longrightarrow \#1, \quad \#2 \longrightarrow \#2 \quad \text{and} \quad \#3 \longrightarrow \#3 \\ 0 & \text{otherwise} \end{cases}$$

where #1, #2 and #3 indicate the first rank, the second rank and the third rank, respectively. These dummy variables take a value of one if the positions are stable between periods $t-1$ and t, and zero otherwise. Apparently, $STAB1$ is more likely to take a value of one than $STAB2$ and $STAB3$. In practice, about 94 percents of $STAB1$ took a value of one in the sample, and the first-ranked firms in 20 of 60 industries continued to keep their positions during the observation period.

Figure 1 presents the sums of $STAB1$, $STAB2$ and $STAB3$ for 60 industries in each year, respectively. It is found that the stability of market leadership positions is not constant over time. In particular, the leadership positions appear to be more stable at the stagnant periods such as 1979-80, 1985-86 and the 1990s. Figure 1 suggests that macro-economic conditions are important as factors affecting the stability of leadership positions. In addition, Table A (in Appendix) presents the sums of $STAB1$, $STAB2$ and $STAB3$ for 24 years in each industry, respectively. While leadership positions are fairly rigid, for example, in the oil paints industry, they are relatively instable in the finishing machines industry. Since the extent of stability of leadership positions differs across industries, industry-specific characteristics also seem to be important to determine the stability of leadership positions.

In this paper, we estimate the determinants of stability of market leadership positions in the industries. With respect to independent variables, industry concentration ($CONC$) is used to identify the relationship between the stability of leadership positions and concentration. Here, we measure the degree of concentration by the sum of the squares of each market share for the three top-ranked firms.[5] From the traditional viewpoint, it has been considered that the collusion among top-ranked firms is more likely to occur and their market shares or positions are more stable in highly concentrated in-

[5] Although several previous studies (e.g., Mueller and Hamm, 1974; Mueller, 1986) had used a measure based on the four top-ranked firms as the degree of concentration, we did not use it because market share data on the four top-ranked firms in some industries are not obtainable from the data source. In this paper, we use the sum of the squares of each market share for the three top-ranked firms rather than the three-firm concentration ratio, in order to control the market share dispersion between the top-ranked firms. The correlation coefficient between $CONC$ and the three-firm concentration ratio is 0.92 and, in practice, the results were very similar to each other.

dustries.[6] Therefore, it is predicted that the effect of concentration on the stability of leadership positions is positive. On the other hand, Davies and Geroski (1997) emphasized that it is difficult to accept the traditional view that high concentration implies the lack of competition. Sakakibara and Porter (2001) also found that the relationship between market share instability and concentration is positive. In this respect, there remains a possibility that the effect of concentration on the stability of leadership positions is negative.

As other independent variables, industry size ($LNSZ$) is included in the model. Doi (2001) argued that market leadership in larger sized industries are more stable than in smaller sized ones. This variable, however, is used to control the difference of industry size rather than to identify the determinants of stability of market leadership positions. In addition, we use industry growth (GRS) as an independent variable. High growth of market demand may provide potential entrants more opportunities for new entry, and accelerate the disequilibration among incumbents including leading firms.[7] It is predicted, therefore, that industry growth has a negative impact on the stability of leadership positions.[8]

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[6] Shepherd (1970), for example, found that successful collusion would tend to hold market shares virtually constant. The stability of market shares, therefore, tends to occur in oligopolistic industries, since it is associated with collusion among leading firms. Doi (2001) found that concentration leads to less market leadership volatility in Japanese manufacturing industries.

[7] For more discussion on the relationship between industry growth and new entry, see, for example, Geroski (1995).

[8] As another independent variable, we obtained data on the net entry rate at the six-digit SIC level from the *Census of Manufactures*. However, since there was a highly positive correlation between the net entry rate and industry growth in our sample, we reported only the result estimated without the variable for the net entry rate. In practice, we estimated

Moreover, the variable for the real growth rate of gross domestic product (GDP) ($GDPGR$) is included to control the time-specific effects due to macro-economic conditions. As already argued, the extent of stability of market leadership positions is not constant over time in the sample. Therefore, there may be a significant relationship between the stability of leadership positions and macro-economic conditions. As mentioned earlier, the leadership positions indeed seem to be more stable at the stagnant periods. Also, Yamawaki (1991) found that real GDP growth is positively associated with the net entry rate in Japanese manufacturing industries. In this respect, it is predicted that the effect of real GDP growth on the leadership stability is negative.

All monetary values are converted into real values with the use of the deflator of gross domestic expenditures. The definitions of these variables and the descriptive statistics are shown in Table 1. By using the variables, the model is written as follows:

$$\begin{aligned}\text{Prob}(STAB_{it} = 1) = f(&\beta_0 + \beta_1 CONC_{it-1} + \beta_2 LNSZ_{it-1} + \beta_3 GRS_{it} \\ &+ \beta_4 GDPGR_t + u_i)\end{aligned}$$

where $STAB_{it}$ represents $STAB1_{it}$, $STAB2_{it}$ or $STAB3_{it}$, $f(\cdot)$ is the cumulative distribution function of the standard normal or logistic distribution, u_i is an industry-specific term, and β_0, $\beta_1, \ldots, \beta_4$ are parameters to be estimated. The independent variables, $CONC_{it-1}$ and $LNSZ_{it-1}$, are measured at period $t-1$ in order to clarify the causality. The variables, GRS_{it} and $GDPGR_t$,

the model with this variable, but we could not find any significant results.

take the value of changes between periods $t-1$ and t, respectively.

4. Empirical results

As is shown in Appendix, the number of industries is 60 in the sample. The observation period for the dependent variable is 1977-2001. As a result, we obtain 1440 observations, and the sample consists of balanced panel data.

Tables 2, 3 and 4 show the estimated results for the determinants of stability of market leadership positions. The dependent variables are binary, and the parameters are estimated by a random-effects probit model and a random-effects logit model. The component error terms including u_i are correlated within an industry, but not across industries. The correlation coefficient between the error terms is denoted by ρ. Furthermore, following Fisman and Raturi (2004), we use Chamberlain's (1980) conditional fixed-effects logit model to estimate the parameters. In this regression, some industries are dropped out of the sample due to all positive outcomes during the observation period, which results in the reduction of the sample size. By using these possible econometric models, we attempt to identify more robust relationships.[9]

With respect to industry concentration ($CONC$), the coefficients on stability of market leadership positions are positive and statistically significant in Tables 2, 3 and 4, although the coefficient is not statistically significant in column (i) of Table 4. These findings indicate that leadership positions are

[9] As an alternative method, we also used a population-averaged model. The results were very similar to the above ones. For more details on binary choice models for panel data, see, for example, Wooldridge (2001).

more stable in highly concentrated industries, which is consistent with that of Mueller (1986). The result suggests that concentration is positively related to the stability of leadership positions. Given that the instability of leadership positions is associated with competition, the result implies that highly concentrated industries are not effectively competitive, although we must identify the relationship between the leadership stability and performance in order to clarify more accurately the meaning of leadership stability.

The effects of industry size ($LNSZ$) are positive and statistically significant in Table 4, implying that market leadership positions in industries with larger demand size are more likely to be stable than relatively small sized industries. The result is consistent with Doi's (2001) findings, although rather this variable is used to control the difference of sizes among industries. In Tables 2 and 3, the effects of $STAB2$ and $STAB3$ are not found, but the coefficients of $STAB1$ are statistically significant. On the other hand, the coefficients of industry growth (GRS) on the stability of leadership positions are negative as our expectation. The result implies that uncertainty in market demand leads to more turnover of market leaders, although the coefficients are not statistically significant.

Finally, with respect to the real growth rate of GDP ($GDPGR$), its effects on the stability of market leadership positions are negative and statistically significant.[10] It is found that leadership positions tend to be less

[10] Instead of real GDP growth as a measure of macro-economic conditions, we also estimated a model with an unemployment rate at period $t-1$. The coefficients of this variable

stable during the periods of high economic growth. As mentioned earlier, leadership positions appear to be more stable during the periods of 1979-80, 1985-86 and the 1990s. These periods correspond to recession years due to the second oil crisis, the Plaza Accord and the so-called bubble economy burst in Japan. Therefore, industries tend to have less mobility during the recessions. The findings imply that the mobility in industries is sensitive to macro-economic conditions, and that policy makers should take into account the importance of macro-economic conditions in evaluating the dynamics of competition. Furthermore, from the viewpoint of management strategy, the findings may indicate that firms have pursued their growth during the high economic growth period, but they have pursued other performance such as profitability than firm growth during the recession.

5. Conclusions

Using a newly constructed panel data set, we investigated the stability of market leadership positions as a measure of market mobility. This paper not only showed the extent of stability of leadership positions across industries over time, but also empirically examined the impacts of industry-specific characteristics and macro-economic conditions on the stability of leadership positions. It was found leadership positions are more stable in highly concentrated industries. In addition, this paper provided evidence that leadership positions

on the stability of leadership positions were positive and statistically significant at the 1% level.

are sensitive to macro-economic conditions, and that high economic growth tend to induce the turnover of market leaders.

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Figure 1: Stability of market leadership positions

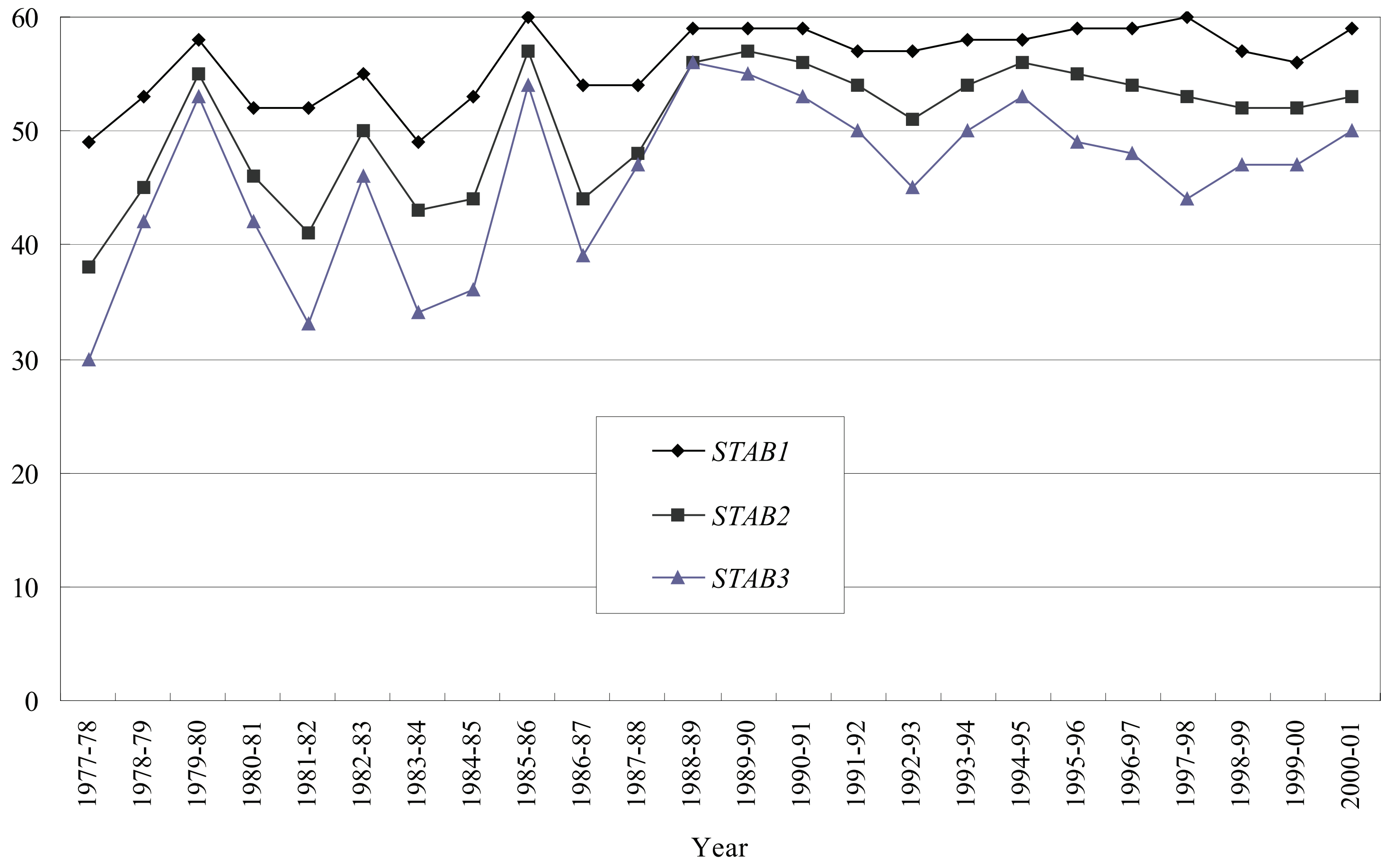

Table 1: Variable definitions and descriptive statistics

Variable	Definition	Mean	S.D.
(Dependent variable)			
$STAB1$	Dummy variable: 1 if the position of the first-ranked firm is stable, 0 otherwise.	0.935	0.247
$STAB2$	Dummy variable: 1 if the positions of the two top-ranked firms are stable, 0 otherwise.	0.843	0.364
$STAB3$	Dummy variable: 1 if the positions of the three top-ranked firms are stable, 0 otherwise.	0.766	0.424
(Independent variable)			
$CONC$	Sum of the squares of each market share for the three top-ranked firms.	0.119	0.081
$LNSZ$	Logarithm of the value of industry's shipments.	11.497	0.967
GRS	Difference of the value of industry's shipments, divided by the value of industry's shipments.	0.011	0.154
$GDPGR$	Real GDP growth rate.	0.028	0.020

Note: All monetary values are millions of yen. S.D. indicates standard deviation. The number of observations is 1440.

Table 2: Estimated results: random-effects probit regression

	(i) $STAB1$	(ii) $STAB2$	(iii) $STAB3$
$CONC$	1.722*	2.419***	2.503***
	(0.907)	(0.740)	(0.702)
$LNSZ$	0.141*	0.059	0.051
	(0.074)	(0.059)	(0.060)
GRS	−0.048	−0.059	−0.081
	(0.373)	(0.272)	(0.254)
$GDPGR$	−9.600***	−7.013***	−3.558*
	(2.931)	(2.209)	(2.000)
Constant term	0.095	0.307	−0.010
	(0.854)	(0.685)	(0.697)
ρ	0.103	0.090	0.108
	(0.049)	(0.033)	(0.033)
LR test($\rho = 0$)	6.44***	15.96***	29.41***
χ^2	18.20***	21.43***	16.10***
Log likelihood	−334.016	−605.637	−758.489
Number of observations	1440	1440	1440

Note: Standard errors in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 3: Estimated results: random-effects logistic regression

	(i) $STAB1$	(ii) $STAB2$	(iii) $STAB3$
$CONC$	3.578^{*}	4.517^{***}	4.418^{***}
	(1.879)	(1.392)	(1.246)
$LNSZ$	0.281^{*}	0.111	0.089
	(0.150)	(0.107)	(0.123)
GRS	-0.107	-0.059	-0.135
	(0.710)	(0.493)	(0.433)
$GDPGR$	-19.397^{***}	-12.678^{***}	-5.811^{*}
	(5.884)	(3.997)	(3.440)
Constant term	-0.169	-0.381	-0.094
	(1.731)	(1.248)	(1.203)
ρ	0.108	0.089	0.097
	(0.057)	(0.034)	(0.030)
LR test($\rho = 0$)	5.68^{***}	15.92^{***}	29.86^{***}
χ^2	18.22^{***}	21.13^{***}	15.68^{***}
Log likelihood	-334.354	-605.631	-758.313
Number of observations	1440	1440	1440

Note: Standard errors in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 4: Estimated results: conditional fixed-effects logistic regression

	(i) $STAB1$	(ii) $STAB2$	(iii) $STAB3$
$CONC$	2.124	9.280***	8.631***
	(4.422)	(2.602)	(2.207)
$LNSZ$	0.916**	0.567**	0.778***
	(0.411)	(0.287)	(0.257)
GRS	0.390	0.194	0.223
	(0.718)	(0.502)	(0.451)
$GDPGR$	−20.065***	−14.424***	−7.419**
	(5.900)	(4.054)	(3.485)
χ^2	17.07***	27.35***	27.74***
Log likelihood	−234.564	−468.514	−602.028
Number of observations	960	1344	1416

Note: Some industries are dropped out of the sample due to all positive outcomes during the observation period. Standard errors in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Appendix

Table A. Industries in the sample

SIC code	Industry	$N1$	$N2$	$N3$	/All years
121212	Butter	24	21	20	/24
121213	Cheese	24	20	18	
124111	Fermented bean paste 'miso', including miso powder	22	22	14	
124211	Soy sauce and edible amino acids, including soy sauce powder and solid	24	22	19	
133112	Green tea (finished)	24	24	19	
205312	Cationic surface-active agents	22	22	22	
205313	Nonionic surface-active agents	24	22	19	
205411	Oil paints	24	24	24	
205412	Lacquers	24	23	23	
205417	Thinner	23	22	22	
207921	Toothpaste	24	23	21	
233111	Conveyer rubber belts	22	20	19	
233211	Rubber hoses	23	21	20	
261118	Small bar steel	21	15	8	
261127	Cold rolled common steel, including cold rolled chrome sheets and regenerated steel sheets	24	17	15	
261131	Cold rolled common wide steel loop in coil, less than 600mm width	24	23	23	
261132	Cold finished common steel loops in coil, less than 600-mm width	21	20	18	
261152	Hot drawn special pipes, except bending rolled special pipes	21	17	14	
265211	Galvanized steel sheets, including galvanized steel loops	24	22	20	
291211	Steam turbines	22	20	20	
291311	General gasoline and oil engines, including general gas engines	23	22	20	
291312	General diesel engines	20	22	20	
292111	Power cultivators and walking tractors, including walking tractors without engines and garden tractors	23	18	17	
293211	Wheeled tractors	24	21	21	
294411	Special steel cutting tools	24	23	19	

Note: $N1$, $N2$ and $N3$ indicate the sums of $STAB1$, $STAB2$ and $STAB3$, respectively.

Table A. Industries in the sample (continued)

SIC code	Industry	$N1$	$N2$	$N3$	/All years
294412	Carbide tools, except powdered and metallic carbide tools	21	20	20	/24
294414	Pneumatic tools	23	21	21	
294415	Power tools	22	22	20	
295111	Machinery for man-made fiber	24	22	19	
295312	Finishing machines	22	13	8	
296111	Grain treating machinery and equipment	22	22	19	
296115	Meat and seafood products manufacturing machinery	21	19	18	
296412	Bookbinding machinery	21	13	12	
296611	Injection molding machinery	22	18	17	
296612	Extruders	22	21	20	
297311	Elevators	24	24	20	
297312	Escalators, including automatic-moving sidewalkers	24	24	23	
297411	Overhead travelling cranes	23	23	21	
297421	Winding machines	23	22	19	
297422	Conveyers	22	21	19	
297711	Hydraulic pumps	24	20	15	
297712	Hydraulic motors	19	19	18	
297818	Dust collectors	23	20	16	
298311	Refrigerators	21	21	21	
301111	Turbine generators (AC)	20	19	19	
301115	Three-phase induction motors, 70W or more	18	18	18	
301211	Standard transformers	22	19	18	
301212	Non-standard transformers	22	20	20	
301213	Transformers for special-use	21	17	15	
301214	Instrument transformers	21	21	21	
301911	Condensers	22	19	16	
302135	Electric refrigerators	24	21	19	
308212	Diode	20	17	14	
319112	Forklift trucks	23	20	15	
321611	Industrial measures	24	22	19	
321612	Precision measuring machines and instruments	23	18	16	
321711	Optical analytical instruments	24	24	23	
325412	Exchange lenses for cameras	19	17	15	
344112	Tin and antimony products	22	19	17	
344211	Ball-point pens	20	16	15	
	Total number in all industries	1346	1214	1103	/1440

Note: $N1$, $N2$ and $N3$ indicate the sums of $STAB1$, $STAB2$ and $STAB3$, respectively.