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The turnover of market leaders in growing and declining industries*

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Abstract

This paper explores the turnover of market leaders in the manufacturing and information and communications industries in Japan. We propose indices for market mobility by focusing on the turnover of market leaders and examine how the likelihood of the turnover of market leaders differs across industries. We provide evidence that market leaders are more likely to be replaced by competitors not only in growing industries but also in declining industries. Moreover, the results reveal that the turnover of market leaders is more likely to occur in research and development-intensive industries. Furthermore, the interaction effects of industry growth and concentration indicate that the turnover of market leaders is more likely to occur in declining industries with high concentration.

JEL Classifications: C25; D43; L13

Keywords: Industry growth; Market leader; Turnover

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1. Introduction

Many, but not all, managers are concerned about their firms' ranking at the top of the markets in which they operate (e.g., Geroski and Toker, 1996). Some managers make decisions in order to perform well relative to their competitors, while paying attention to their market shares, rather than profits. This is partly because profits are difficult to forecast or because a focus on profits may lead to a short-term orientation at the expense of long-term considerations (e.g., Armstrong and Collopy, 1996). By gaining higher market share, firms can exploit market power and have competitive advantages in the industry. Hence, sustaining a leadership position is considered to be one of the key managerial objectives for market leaders.

If a market leader holds a competitive advantage, the ranking of market shares will be stable in the industry. Conversely, if a competitor against a market leader creates a breakthrough product, the ranking of market shares will be vulnerable in the industry. Therefore, we can say that the ranking of market shares reflects the degree of competition in the industry. In this respect, a change in the ranking of market shares not only attracts managers, but also provides useful information on the dynamics of the competitive process for policy makers.

From the perspective of competition policy, much attention has been paid to how to examine the factors affecting competition in industries. To identify the degree of competition, scholars have proposed some indices for market mobility.[1] Traditionally, the n-firm concentration ratio and the Hirschman–Herfindahl index (HHI) have been regarded as measures of market mobility. However, these indices ultimately tend to be static and ignore the dynamics of the industry because they simply provide a snapshot of market share distribution. More specifically, market mobility may appear high, even though the concentration ratio is high. Indeed, the market shares of oligopolistic firms, which compete with each other fiercely, can change, even in highly concentrated industries. Therefore, further research is needed to explore how

[1] As explained later, some indices are based on the market shares of the top three-ranked firms in the industry. In this respect, market mobility can be regarded as leadership mobility; indeed, Doi (2001) called this "market leadership mobility" or "market leadership volatility."

to measure market mobility and to identify the factors affecting the dynamics of the competitive process at the industry level.

This paper explores the turnover of market leaders in the manufacturing and information and communications (ICT) industries in Japan. We propose indices for market mobility by focusing on the turnover of market leaders and examine how the likelihood of the turnover of market leaders differs across industries. We provide evidence that market leaders are more likely to be replaced by competitors not only in growing industries but also in declining industries. Moreover, the results reveal that the turnover of market leaders is more likely to occur in research and development (R&D)-intensive industries. Furthermore, the interaction effects of industry growth and concentration indicate that the turnover of market leaders is more likely to occur in declining industries with high concentration.

The remainder of the paper is organized as follows. The following section discusses how to measure market mobility and reviews the literature on this topic. Section 3 introduces the method used in this paper and Section 4 describes the data and variables. The estimation results are presented in Section 5. Finally, the findings of this paper are concluded.

2. Market mobility

2.1. Market share measures

To discuss market structure and competition, a substantial number of studies have explored how to measure market mobility. Mueller and Hamm (1974) and Mueller and Rogers (1980, 1984) used changes in the four-firm concentration ratio as a measure of market mobility. Doi (2001) examined the determinants of market mobility, using data on Japanese manufacturing industries. These studies proposed market share measures, using data on changes in the concentration ratio or in market share (e.g., Caves and Porter, 1978).

However, as Kato and Honjo (2006) pointed out, even if the concentration ratio is found to be almost constant over time, fierce competition may still exist among leading firms. That is, the concentration ratio ignores the shift in market shares among leading firms. Since earlier studies were based on cross-section data, their results showed only the difference in the concentration ratio or market shares between industries in a year. In this respect, these studies did not lose sight of the dynamics of the industry.

Afterwards, some scholars examined the determinants of market mobility, using panel data on market shares. For instance, Sakakibara and Porter (2001) proposed an index for market mobility (they called this "market share instability") that represents changes in the market shares of market leaders. They found robust evidence that domestic rivalry has a positive and significant relationship with trade performance measured by world export share, particularly when R&D intensity reveals opportunities for dynamic improvement and innovation. Kato and Honjo (2006) also used some of these indices to measure market mobility, finding a significant relationship between concentration and market share instability and showing that the market shares of leading firms are more stable in highly concentrated industries.

Although these studies employed panel data in their analyses, it is doubtful whether these indices capture market mobility when market leaders change. Without tracing the market shares of the firms themselves over time, we cannot accurately measure changes in the market shares of market leaders. In other words, we may calculate the changes in market shares by matching a first-ranked firm in a year with a different firm that is first ranked in the following year. However, it is cumbersome to trace the market shares over time, mainly because of the limitation of data on market shares. In practice, marketing companies or governments tend to target only major firms, for example, the top 10-ranked firms. Therefore, if a firm drops out of the top ranking in the industry, data on the firm's market share are not obtainable from the data source. This fact indicates that we cannot measure the changes in the market shares of market leaders that are no longer top ranked in the following year, which causes underestimation bias.

2.2. Turnover measures

The market share measures used in the literature may capture changes in the market shares of different firms over time (e.g., Doi, 2001; Sakakibara and Porter, 2001; Kato and Honjo, 2006). To measure market mobility, therefore, some studies have attempted to use turnover measures based on firms' positions (ranking) in the industry. For example, Joskow (1960) proposed a turnover measure by means of the rank correlation coefficient. Mueller (1986) examined the stability of market leadership positions, using a binary choice model. Marlow and Wright (1987) also proposed mobility and turnover measures, using the number of changes in ranking among the top three-ranked firms and the number of times that firms move into the top three ranking. Moreover, Kambhampati (2000) identified market leaders, using a dummy variable for leadership stability, which reflects industry competitiveness. Similarly, Kato and Honjo (2005) examined market mobility in Japanese industries, using the index for market leadership instability, and found that leadership positions are sensitive to macroeconomic conditions.[2] As Geroski and Toker (1996) emphasized, turnover measures reflect the dynamics of the competitive process more accurately than static measures of competition, such as the n-firm concentration ratio.

Turnover measures can capture changes in the ranking of certain firms. In this respect, turnover measures may more accurately reflect market mobility. Additionally, turnover measures have more advantages than market share measures when we construct a data set. Access to a data source is often restricted, and information on firms' market shares tends to be concealed. Compared with information on market shares, however, information on firms' rankings is more obtainable from a data source. More importantly, as already explained, if a firm drops out of the top ranking, we cannot trace changes in the market share of the firm. By contrast, we can obtain information on whether the firm drops out of the top ranking. As a result, turnover measures are more obtainable than market share measures.

[2]Furthermore, Kato and Honjo (2009) examined the persistence of market leadership, using a proportional hazards model, and Honjo and Kato (2008) applied this to a discrete-time duration model.

2.3. Industry growth patterns

When examining the factors affecting market mobility, some scholars have paid attention to the life cycle patterns of industries (e.g., Gort and Klepper, 1982; Agarwal and Gort 1996; Klepper, 1997). According to the perspective of the industry life cycle, the number of firms changes over time and increases with rapid growth through innovation in the early stage. Bayus and Agarwal (2007) argued that industries follow the product life cycle pattern: an initial period of intense competition, significant entry and exit of firms, and fragmented market shares is eventually followed by a shakeout in which the number of firms dramatically falls, leading to higher industry concentration. More importantly, as Klepper (1996) emphasized, eventually the rate of change in the market shares of the largest firms is low and the leadership of the industry stabilizes.

Following these arguments, we suggest that market mobility depends on the industry life cycle. However, in practice, identifying the life cycle patterns in each industry can be challenging. Meanwhile, we may be able to classify the growth patterns of industries, using concentration and industry growth, because concentration and industry growth appear to represent life cycle patterns. Specifically, high industry growth tends to be seen in earlier stages, while concentration tends to occur in later stages. In addition, high industry growth may provide more opportunities to gain market share, whereas concentration is often caused through the shakeout in the industry. Therefore, it is predicted that market mobility is higher in industries characterized by high growth and low concentration. Furthermore, market mobility is higher in R&D-intensive industries because discontinuous innovations often disrupt established market positions. Such growth patterns and industry-specific characteristics may thus determine market mobility.

3. Method

Because of the advantages of turnover measures, we propose indices to capture market mobility, using information on firms' rankings in the examined industries.

In this paper, market mobility is measured by the turnover of market leaders. Below, we explain the method used to examine the factors affecting the turnover of market leaders.

Consider whether firm j that is ranked highly (more precisely, top three ranked in this paper) in year t will be ranked highly in year $t+1$ in industry $i(=1,\ldots,n)$. Let R_i denote the set of firm j in industry i, and $j \in R_i$. We assume that the ranking of firms is determined by firm j's market share (or sales) in industry i and that it is measured by discrete time. Let $s_{jt}(>0)$ denote firm j's market share in year t. If the ranking of market shares frequently changes in an industry, the industry can be characterized as having higher market mobility. To measure market mobility in industry i, we define three indices, $Y(1)_{it}$, $Y(2)_{it}$, and $Y(3)_{it}$, for the top one-, two-, and three-ranked firms by binary variables based on the turnover of market leaders as follows:[3]

$$\begin{aligned}
Y(1)_{it} &= I\Big(s_{kt+1} < \max_{j\in R_i|j\neq k} s_{jt+1} \mid s_{kt} = \max_{j\in R_i} s_{jt}\Big) && (1)\\
Y(2)_{it} &= I\Big(s_{kt+1} < \max_{j\in R_i|j\neq k} s_{jt+1} \cup s_{lt+1} < \max_{j\in R_i|j\neq k,l} s_{jt+1} \mid s_{kt} = \max_{j\in R_i} s_{jt},\\
&\qquad s_{lt} = \max_{j\in R_i|j\neq k} s_{jt}\Big) && (2)\\
Y(3)_{it} &= I\Big(s_{kt+1} < \max_{j\in R_i|j\neq k} s_{jt+1} \cup s_{lt+1} < \max_{j\in R_i|j\neq k,l} s_{jt+1} \cup s_{mt+1} < \max_{j\in R_i|j\neq k,l,m} s_{jt+1}\\
&\qquad \mid s_{kt} = \max_{j\in R_i} s_{jt}, s_{lt} = \max_{j\in R_i|j\neq k} s_{jt}, s_{mt} = \max_{j\in R_i|j\neq k,l} s_{jt}\Big), && (3)
\end{aligned}$$

where $I(\cdot)$ represents an indicator function and $k, l, m \in R_i$. We define that $Y(\cdot)_{it} = 1$ if the turnover of market leaders occurs between t and $t+1$, and $Y(\cdot)_{it} = 0$ otherwise.

These indices, $Y(1)_{it}$, $Y(2)_{it}$, and $Y(3)_{it}$, indicate the state of the turnover of firm j's ranking and therefore reflect market mobility. That is, $Y(1)_{it}$ indicates whether the first-ranked firm changes and $Y(2)_{it}$ indicates whether either the first- or second-ranked firm changes in industry i between t and $t+1$. To identify the

[3] Because of the limitation of data on market shares, we focus on the top one-, two-, and three-ranked firms for the indices used in this paper. We also measured the index for the top four-ranked firms and estimated the determinants of the turnover of market shares for them. We obtained similar results.

factors affecting these probabilities, we formalize $Y(\cdot)_{it}$ as the following function:

$$\Pr(Y(\cdot)_{it} = 1) = F\left(x'_{it}\beta + \mu_i\right), \tag{4}$$

where x_{it} indicates a vector of the independent variables, μ_i is an industry-specific term, and β is a vector of the coefficients for x_{it}. In Eq. (4), the industry-specific term, μ_i, is included to control for unobserved heterogeneity. To estimate the parameters, we specify $F(\cdot)$, using a binary choice model such as a logit model, and identify the factors affecting the turnover of market leaders in the industry by maximizing the likelihood function.

Moreover, these indices, $Y(1)_{it}$, $Y(2)_{it}$, and $Y(3)_{it}$, can be regarded as categorical and ordered. More precisely, we find the following relationship for $Y(1)_{it}$, $Y(2)_{it}$, and $Y(3)_{it}$:

$$\Pr(Y(1)_{it} = 1) \leq \Pr(Y(2)_{it} = 1) \leq \Pr(Y(3)_{it} = 1). \tag{5}$$

By aggregating the information on these indices, we can newly construct an index with an ordered response. Let Z_{it} denote an observed ordinal response, and we define Z_{it} as follows:

$$Z_{it} = \begin{cases} 0 & \text{if } Y(3)_{it} = 0 \\ 1 & \text{if } Y(3)_{it} = 1 \cap Y(2)_{it} = 0 \\ 2 & \text{if } Y(2)_{it} = 1 \cap Y(1)_{it} = 0 \\ 3 & \text{if } Y(1)_{it} = 1. \end{cases} \tag{6}$$

In this case, the random-effects model can be written as follows:

$$\Pr(Z_{it} > k) = H\left(x'_{it}\gamma + \nu_i - \kappa_k\right), \tag{7}$$

where $k(= 1, 2, 3)$ is a possible outcome and κ_k is a cutpoint for k. To estimate the parameters, we specify $H(\cdot)$, using an ordered choice model such as an ordered logit model, and identify the factors affecting the turnover of market leaders in the industry by maximizing the likelihood function.

4. Data

4.1. Data source

We constructed a new data set for Japanese industries during the period 1991–2010, using the Survey of Concentration Ratio on Production and Shipment (CRPS)

(*Seisan Shukka Shuchudo Chosa*), which has been surveyed by the Japan Fair Trade Commission (JFTC) to monitor market structure.[4] The CRPS covers a large number of industries and the industries surveyed roughly correspond to the six-digit Standard Industrial Classification level.[5]

This source includes data on domestic production, based on quantity of production and value of shipment of the top 10 firms and concentration in each industry during the period 1991–2010. While data on either quantity of production or value of shipment were reported for some industries, data on both quantity of production and value of shipment were reported for other industries. To construct as long a period of panel data as possible, we employed data on quantity of production if the observation period for quantity of production was longer than that for value of shipment; otherwise, we employed data on value of shipment to obtain a larger sample size.[6] As already mentioned, we targeted top three-ranked firms to capture market mobility and collected data on the top three-ranked firms available in the CRPS. We identified which firms are ranked highly and whether market leaders within the top three are replaced by competitors in the examined industries.

Table 1 presents the number of observations in each year and industry. We measured changes in the turnover of market leaders for 669 industries during the period 1991–2010 (19 years). The total number of observations is 5,627. The sample is unbalanced panel data because the JFTC does not always survey market shares for all industries. As shown in Table 1, manufacturing accounts for a major proportion of the observations, followed by ICT. This is because the market shares of these industrial products have been traditionally surveyed by the JFTC. Meanwhile, market mobility depends on the level of R&D intensity in the industries. However, it is not easy to obtain data on R&D expenditure in some industries (e.g., wholesale and retail trade) because such data tend not to be reported for firms. To identify the factors affecting the turnover of market leaders, we therefore focus only on the

[4]The CRPS was surveyed every other year in which annual levels of production and shipment for two consecutive years are collected.

[5]For more discussion on the CRPS, see also Kato and Honjo (2009).

[6]If the observation period for quantity of production equaled that for value of shipment, we employed data on value of shipment.

manufacturing and ICT industries.

The sample for the estimation is composed of 5,009 observations in these industries. The number of industries is 594. Regarding the turnover of market leaders, Figure 1 describes the means of $Y(1)$, $Y(2)$, and $Y(3)$ during the observation period. The means of these indices indicate the ratio (probability) of the turnover of market leaders on average. The means of $Y(1)$, $Y(2)$, and $Y(3)$ are 0.121, 0.263, and 0.395, respectively. That is, the turnover of the first-ranked firms occurs with a probability of approximately 12%, while the turnover of the first-, second-, or third-ranked firm occurs with a probability of approximately 40%.

4.2. Variables

When discussing the factors affecting the turnover of market leaders, we first focus on the relationship between the turnover of market leaders and concentration. Concentration, which is often regarded as a static measure of competition, represents market structure and, as discussed, indicates the process of industry growth. The traditional view in competition policy is that high concentration may represent low mobility in the industry. However, the turnover of market leaders substantially differs from concentration because it reflects the dynamics of the industry. In this paper, therefore, we identify whether the turnover of market leaders depends on concentration in the industry. It is plausible that concentration has a negative effect on the turnover of market leaders. In other words, market leaders are less likely to maintain their positions in low concentrated industries. It also seems natural that the likelihood of the turnover of market leaders is negatively related to the difference in market shares between market leaders.

We measure market concentration, using the HHI (HHI).[7] In addition to HHI, we use a dummy variable for concentration, H_HHI, to identify a high concentration level. Besanko et al. (2013) classified the nature of competition into four types—perfect competition, monopolistic competition, oligopoly, and monopoly—and regarded perfect and monopolistic competition as having the HHI below 0.2. In

[7] In addition to the HHI, the n-firm concentration ratio has been used as a static measure of competition. We also used the four-firm concentration ratio and obtained similar results.

practice, we can divide our sample roughly in half by defining high concentration as $HHI \geq 0.2$.

Then, as discussed, industry growth reflects life cycle patterns, and the turnover of market leaders depends on the industry life cycle. As Kato and Honjo (2006, 2009) argued, high industry growth may provide potential entrants more opportunities for new entry. At the same time, high industry growth may provide market leaders' competitors with more opportunities to increase their market shares. Thus, it is hypothesized that the turnover of market leaders is more likely to occur in growing industries. Moreover, the more volatile market demand is, the higher is the likelihood of the turnover of market leaders. Market leaders face difficulties in maintaining their market shares in demand-volatile industries because they tend to be particularly affected by demand fluctuations regardless of positive or negative growth. In addition, as Ghemawat and Nalebuff (1985) suggested, firms with larger market shares face difficulties surviving in declining industries. In fact, Davies and Geroski (1997) found that both positive and negative growth in demand bring greater uncertainty for leading firms. Thus, it is hypothesized that the turnover of market leaders is more likely to occur in not only growing industries but also declining industries.

To identify the effect of demand volatility on the turnover of market leaders, we use industry growth, $GROW$. In addition, as the relationship may be non-linear, its squared term, $GROW\_SQ$, is also included in the regression model. Additionally, the impact of positive industry growth may differ from that of negative industry growth on the turnover of market leaders. For this reason, we use $GROW\_P$ and $GROW\_N$, instead of $GROW$ and $GROW\_SQ$, to identify the difference in the effect of industry growth between growing and declining industries.

While, as already argued, concentration and industry growth affect the turnover of market leaders, the interaction effects of concentration and industry growth may be significantly associated with market mobility. The turnover of market leaders may occur in highly concentrated industries because of the intense competition among them. Moreover, even if concentration is high, market leaders may still find survival difficult in declining industries. As decreasing demand may damage their lion's shares, the turnover of market leaders is more likely to occur in declining industries. Therefore, it is hypothesized that the negative impact of concentration on the turnover of market leaders is mitigated in such industries. The interaction effects of concentration and industry growth provide important insights into how market mobility depends on growth patterns and industry-specific characteristics.

In addition to concentration and industry growth, market mobility may be accelerated by innovations. As discussed, discontinuous innovations often disrupt established market positions, thereby promoting competition in the industry. Indeed, there are distinct patterns in market dynamics between industries with low and high R&D intensities (e.g., Dosi et al., 1997). Further, there may be different life cycle patterns between these industries (e.g., Gort and Klepper, 1982; Klepper, 1997). In this respect, Davies and Geroski (1997) concluded that R&D and innovation play a major role in affecting the dynamics of market shares. Although technological progress may exert a role as a barrier to entry and mobility, it is considered that the turnover of market leaders is more likely to occur in R&D-intensive industries. The variable for R&D intensity, RD, is defined as the ratio of R&D expenditure to sales in the examined industries.

Additionally, the impact of cartels on competition in the industry has attracted attention from the perspective of competition policy. Although it is not easy to identify the presence of a cartel, including unproven cartels, we use $CARTEL$ to capture discovered cartels over time. The traits of a cartel may persist even after its detection.

Furthermore, several controls are required in the regression model. We include a variable for import products, $IMPORT$, to control for the rate of import products.[8] A variable for industry size is also included in the regression model. We also use a variable for mergers, defined as whether market leaders merge within the industry, because merger may cause the turnover of market leaders. Finally, year dummies are included to control for the macroeconomic conditions associated with the calendar

[8] However, Doi (2001) concluded that imports have no discernible effect.

years in the model.

Table 2 presents the definitions and summary statistics of the variables used in this paper.

5. Estimation results

As the dependent variable is a binary response in Eq. (4), we use the logit model. Then, as it is an ordered response in Eq. (7), we use the ordered logit model. The model includes an industry-specific term, which is assumed to be a random effect, to capture heterogeneity in the market structure of industries. That is, we estimate the parameters, using the random-effects model.[9]

Tables 3, 4, and 5 show the estimation results when $Y(1)$, $Y(2)$, and $Y(3)$ are used as the dependent variable, respectively. In these tables, we provide the estimated coefficients when using the random-effects logit model.[10] We present the results with $GROW$ and $GROW\_SQ$ in column (i) and those with $GROW\_P$ and $GROW\_N$ in column (ii). We also present the results with the interaction term of HHI and $GROW\_P$ and the term of HHI and $GROW\_N$ in column (iii). Additionally, we use H_HHI in column (iv), instead of HHI. Furthermore, Table 6 shows the estimation results when Z is used as the dependent variable. In Table 6, we provide the estimated coefficients when using the random-effects ordered logit model.

As shown in these tables, HHI has a significantly negative effect on the turnover of market leaders in columns (i), (ii), and (iii) of Tables 3–6. Further, the coefficients of H_HHI are negative and significant in column (iv). We also find a negative relationship between the turnover of market leaders and concentration. This relationship is consistent with the findings of Eckard (1987), Doi (2001), Sakakibara and Porter (2001), and Kato and Honjo (2006, 2009). These results indicate that market leaders are less likely to be replaced in highly concentrated industries, suggesting

[9] We used the random-effects logit model, instead of the fixed-effects logit model, because the data set included industries obtainable only for one year. We also obtained similar results when using a random-effects complementary log-log model.

[10] Although it is possible, we did not include an industry dummy for ICT (or manufacturing) in the regression model.

that concentration leads to less competition between market leaders. We thus provide support for the evidence that market mobility is low in highly concentrated industries.

With respect to industry growth, the coefficients of $GROW$ are insignificant, while those of $GROW\_SQ$ are positive at the 1% significance level in column (i) of Tables 3–6. These results reveal that the turnover of market leaders is more likely to occur in demand-volatile industries. The results also indicate that the effect of industry growth on the turnover of market leaders shows a U-shaped relationship, which is consistent with the findings of Davis and Geroski (1997) and Kato and Honjo (2006, 2009). Additionally, the coefficients of $GROW\_P$ are positive and significant, while those of $GROW\_N$ are negative and significant in column (ii). The results indicate that market leaders are more likely to be replaced by competitors not only in growing industries, but also in declining industries. In developed countries including Japan, several industries may face sluggish demand growth in the declining phase. In declining industries, the likelihood of the turnover of market firms is higher, although market leaders may increase their market shares because their competitors sell out their businesses in such industries. These findings suggest that firms have more opportunities to gain leadership positions in declining industries, indicating the possibility of competition between market leaders in such industries.[11]

As for the interaction terms of concentration and industry growth, a positive sign for the interaction terms of HHI and $GROW\_P$ and a negative sign for the interaction terms of HHI and $GROW\_N$ are found in column (iii), although the effects are insignificant in Tables 4, 5, and 6. Additionally, the interaction terms of H_HHI and $GROW\_P$ are positive at the 5% significance level in columns (iv) of Tables 3, 5, and 6. In particular, the interaction terms of H_HHI and $GROW\_N$ are negative at the 1% significance level. These results indicate that market leaders are more likely to be replaced by competitors in growing and declining industries,

[11] However, although corporate restructuring through mergers may affect the turnover of market leaders in declining industries, as shown in these tables, we did not find any significant results for mergers.

even if the industries are highly concentrated. These findings suggest that industry growth, rather than concentration, has a more significant impact on the turnover of market leaders and that demand fluctuations play an important role in enhancing market mobility. Given that high concentration and declining industry growth represent the later stages in the industry life cycle, the turnover of market leaders is more likely to occur in such stages through the intense competition between market leaders.

Moreover, the coefficients of RD are positive at the 1% significance level in Tables 3–6. These results reveal that the turnover of market leaders is less likely to occur in R&D-intensive industries. As Davies and Geroski (1997) argued, R&D has a major effect on the dynamics of market shares. The results reveal that innovations lead to intense competition between market leaders, probably because they often disrupt established market positions. The findings also suggest that, as Kato and Honjo (2009) pointed out, the speed of technological progress differs significantly among industries, indicating the presence of different patterns in market dynamics and life cycles between industries with low and high R&D intensities.

The coefficients of $CARTEL$ are negative but insignificant in Table 4. This negative effect indicates that the turnover of market leaders is less likely to occur in industries where a cartel has been exposed. This finding is consistent with that of Kato and Honjo (2009), indicating that the traits of cartels can persist even after their detection. In addition, the coefficients of $IMPORT$ are negative but insignificant in Table 3. Meanwhile, $SIZE$ has a significantly negative effect on the turnover of market leaders, indicating that the turnover of market leaders is less likely to occur in large industries. Finally, the coefficients of $MERGE(1)$, $MERGE(2)$, and $MERGE(3)$ are insignificant. Although mergers are considered to cause the turnover of market leaders, we find little such evidence.

Furthermore, Tables 3, 4, and 5 may indicate the difference in the determinants of turnover among first-, second-, and third-ranked firms.[12] These tables show that the negative impact of concentration, HHI, is larger only for the turnover of first-

[12]For comparison, Table A1 presents the estimated marginal effects in the Appendix.

ranked firms, while the positive impact of demand fluctuations, $GROW\_SQ$, and R&D intensity, RD, is larger for the turnover of top three-ranked firms. The findings imply that first-ranked firms are more likely to maintain their leadership positions in highly concentrated industries, while second- and third-ranked firms may have opportunities to gain market share in demand-volatile and R&D-intensive industries.

6. Conclusions

This paper has explored the turnover of market leaders in the manufacturing and ICT industries in Japan. We proposed indices for market mobility by focusing on the turnover of market leaders and examined how the likelihood of the turnover of market leaders differs across industries. We provided evidence that market leaders are more likely to be replaced by competitors not only in growing industries but also in declining industries. Moreover, the results revealed that the turnover of market leaders is more likely to occur in R&D-intensive industries. Furthermore, the interaction effects of industry growth and concentration indicated that the turnover of market leaders is more likely to occur in declining industries with high concentration.

This paper has several limitations. First, we did not take into account the effects of market leaders themselves on the turnover of market leaders because we could not identify the list of market leaders from the data source. Therefore, our analysis did not include firm-specific characteristics, including their strategies and technological levels. Second, the JFTC collects data on market shares for its purpose. Therefore, we could not examine the turnover of market leaders when the JFTC did not survey market shares. At the same time, sample selection bias may be present.

Despite the limitations of our analysis, we provided valuable insights into the impact of industry-specific characteristics on market mobility. In particular, our findings suggest that industry growth is conducive to competition among top-ranked firms, even in concentrated industries. While concentration has traditionally been highlighted from the perspective of competition policy, industry growth, in addition to innovations, may rather have more impact on market mobility, which would provide a better understanding of industry dynamics.

Appendix

Table A1 presents the estimated marginal effects for the probability of a positive outcome assuming that $\mu_i = 0$ for $Y(1)$, $Y(2)$, and $Y(3)$.

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Table 1. Distribution of observations by industry

Year	Manufact	ICT	Transport	Who & ret	Services	Others	Total
1991	357	6	3	4	5	4	379
1992	350	6	3	4	5	4	372
1993	367	7	3	6	7	6	396
1994	246	2	3	5	3	6	265
1995	313	2	3	7	4	7	336
1996	270	0	3	7	4	7	291
1997	287	8	6	10	11	11	333
1998	191	4	6	5	5	8	219
1999	267	9	7	6	6	9	304
2000	248	7	7	5	6	9	282
2001	258	9	7	5	7	9	295
2002	190	9	7	4	7	7	224
2003	252	11	7	4	10	7	291
2004	222	11	7	4	8	7	259
2005	258	14	7	4	8	7	298
2006	230	12	7	4	8	7	268
2007	235	13	7	5	8	8	276
2008	227	13	7	5	8	8	268
2009	229	13	8	5	8	8	271
2010	—	—	—	—	—	—	—
Total	4,997	156	108	99	128	139	5,627

Notes: Manufact, ICT, Transport, Who & ret, Services, and Others indicate "Manufacturing," "Information and communications," "Transport," "Wholesale and retail trade," "Services," and "Others," respectively. Others include "Construction," "Electricity, gas, heat supply, and water," "Finance and insurance," "Education, learning support," and "Eating and drinking places, accommodations."

Table 2. Definition and summary statistics of variables

Variable	Definition	Mean	S.D.
(Market mobility)			
$Y(1)$	(See the main text.)	0.121	——
$Y(2)$	(See the main text.)	0.263	——
$Y(3)$	(See the main text.)	0.395	——
(Concentration)			
HHI	Hirschman-Herfindahl index	0.231	0.131
H_HHI	1 if $HHI \geq 0.2$, 0 otherwise	0.517	——
(Industry growth)			
$GROW$	Difference of logarithms of the values of shipment between $t+1$ and t.	−0.024	0.247
$GROW\_SQ$	$GROW \times GROW$	0.062	0.427
$GROW\_P$	$\max\{GROW, 0\}$	0.057	0.141
$GROW\_N$	$\min\{GROW, 0\}$	−0.081	0.179
(R&D intensity)			
RD	Ratio of R&D expenditures to sales	0.034	0.022
(Cartel)			
$CARTEL$	1 if cartels are exposed in t or after t, 0 otherwise	0.031	——
(Import)			
IMP	Ratio of imports to domestic total supply	0.048	0.095
(Size)			
$SIZE$	Logarithm of domestic total supply (million yen)	11.774	1.072
(Merger)			
$MERGE(1)$	1 if the first-ranked firm merges, 0 otherwise	0.012	——
$MERGE(2)$	1 if the first- or second-ranked firm merges, 0 otherwise	0.021	——
$MERGE(3)$	1 if the first-, second-, or third-ranked firm merges, 0 otherwise	0.029	——
(Year dummies)			
$Y90, \ldots Y09$	1 if the year is the observation year, 0 otherwise	——	——

Notes: S.D. indicates standard deviation. The number of observations is 5,009. The variables except for year dummies depend on i and t (year dummies depend only on t).

Table 3. Estimation results for the turnover of the top one firm: $Y(1)$

Variable	(i) Coef.	(ii) Coef.	(iii) Coef.	(iv) Coef.
HHI	-6.615^{***}	-6.812^{***}	-7.957^{***}	
	(0.760)	(0.754)	(0.888)	
H_HHI				-1.010^{***}
				(0.159)
$GROW$	-0.078			
	(0.175)			
$GROW\_SQ$	0.654^{***}			
	(0.125)			
$GROW\_P$		1.824^{***}	1.061^{**}	1.088^{***}
		(0.295)	(0.494)	(0.397)
$GROW\_N$		-1.807^{***}	-0.808	-1.060^{***}
		(0.256)	(0.523)	(0.319)
$HHI \times GROW\_P$			2.902^{*}	
			(1.488)	
$HHI \times GROW\_N$			-4.514^{**}	
			(2.201)	
$H\_HHI \times GROW\_P$				1.185^{**}
				(0.579)
$H\_HHI \times GROW\_N$				-1.355^{***}
				(0.492)
RD	13.998^{***}	13.105^{***}	13.137^{***}	12.425^{***}
	(3.125)	(3.055)	(3.063)	(3.116)
$CARTEL$	-0.911	-0.974^{*}	-0.885	-0.743
	(0.555)	(0.549)	(0.539)	(0.540)
$IMPORT$	-0.705	-0.945	-0.917	0.504
	(0.616)	(0.612)	(0.609)	(0.590)
$SIZE$	-0.292^{***}	-0.276^{***}	-0.268^{***}	-0.143^{**}
	(0.070)	(0.069)	(0.069)	(0.067)
$MERGE(1)$	0.626	0.621	0.618	0.587
	(0.417)	(0.414)	(0.416)	(0.415)
Year dummies	Yes	Yes	Yes	Yes
Number of observations	5,009	5,009	5,009	5,009
Number of industries	594	594	594	594
Log likelihood	$-1,612$	$-1,592$	$-1,588$	$-1,619$
Wald χ^2	207^{***}	241^{***}	242^{***}	207^{***}
LR χ^2 ($\rho = 0$)	142^{***}	120^{***}	120^{***}	138^{***}

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Wald χ^2 is the statistic to test the null hypothesis that all the coefficients equal 0. LR χ^2 is the statistic to test the null hypothesis that $\rho = 0$ where ρ is the proportion of the total variance contributed by the panel-level variance component.

Table 4. Estimation results for the turnover of the top two firms: $Y(2)$

Variable	(i) Coef.	(ii) Coef.	(iii) Coef.	(iv) Coef.
HHI	-4.338^{***}	-4.430^{***}	-4.755^{***}	
	(0.511)	(0.504)	(0.572)	
H_HHI				-0.925^{***}
				(0.122)
$GROW$	2.2×10^{-4}			
	(0.154)			
$GROW\_SQ$	0.537^{***}			
	(0.115)			
$GROW\_P$		1.752^{***}	1.539^{***}	1.400^{***}
		(0.280)	(0.503)	(0.375)
$GROW\_N$		-1.566^{***}	-1.005^{**}	-0.950^{***}
		(0.240)	(0.483)	(0.292)
$HHI \times GROW\_P$			0.831	
			(1.608)	
$HHI \times GROW\_N$			-2.566	
			(1.981)	
$H\_HHI \times GROW\_P$				0.599
				(0.550)
$H\_HHI \times GROW\_N$				-1.369^{***}
				(0.462)
RD	16.495^{***}	15.776^{***}	15.723^{***}	15.784^{***}
	(2.560)	(2.489)	(2.486)	(2.497)
$CARTEL$	-0.360	-0.380	-0.366	-0.301
	(0.333)	(0.327)	(0.326)	(0.327)
$IMPORT$	-0.850^{*}	-1.033^{**}	-0.983^{*}	-0.325
	(0.515)	(0.510)	(0.508)	(0.495)
$SIZE$	-0.145^{***}	-0.127^{**}	-0.123^{**}	-0.064
	(0.055)	(0.054)	(0.054)	(0.053)
$MERGE(2)$	0.388	0.371	0.371	0.372
	(0.257)	(0.257)	(0.258)	(0.257)
Year dummies	Yes	Yes	Yes	Yes
Number of observations	5,009	5,009	5,009	5,009
Number of industries	594	594	594	594
Log likelihood	$-2,528$	$-2,504$	$-2,503$	$-2,515$
Wald χ^2	294^{***}	334^{***}	334^{***}	321^{***}
LR χ^2 ($\rho = 0$)	256^{***}	204^{***}	201^{***}	222^{***}

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Wald χ^2 is the statistic to test the null hypothesis that all the coefficients equal 0. LR χ^2 is the statistic to test the null hypothesis that $\rho = 0$ where ρ is the proportion of the total variance contributed by the panel-level variance component.

Table 5. Estimation results for the turnover of the top three firms: $Y(3)$

Variable	(i) Coef.	(ii) Coef.	(iii) Coef.	(iv) Coef.
HHI	-3.589^{***}	-3.666^{***}	-3.978^{***}	
	(0.444)	(0.437)	(0.499)	
H_HHI				-1.033^{***}
				(0.114)
$GROW$	0.068			
	(0.154)			
$GROW\_SQ$	0.369^{***}			
	(0.115)			
$GROW\_P$		1.847^{***}	1.558^{***}	1.211^{***}
		(0.318)	(0.597)	(0.396)
$GROW\_N$		-1.404^{***}	-0.786	-0.716^{**}
		(0.253)	(0.487)	(0.301)
$HHI \times GROW\_P$			1.172	
			(2.039)	
$HHI \times GROW\_N$			-2.812	
			(1.965)	
$H\_HHI \times GROW\_P$				1.394^{**}
				(0.617)
$H\_HHI \times GROW\_N$				-1.689^{***}
				(0.489)
RD	17.386^{***}	16.806^{***}	16.750^{***}	17.182^{***}
	(2.431)	(2.366)	(2.364)	(2.339)
$CARTEL$	-0.619^{**}	-0.646^{**}	-0.633^{**}	-0.575^{*}
	(0.309)	(0.305)	(0.304)	(0.301)
$IMPORT$	-0.643	-0.831^{*}	-0.779	-0.430
	(0.488)	(0.484)	(0.483)	(0.468)
$SIZE$	-0.165^{***}	-0.147^{***}	-0.143^{***}	-0.104^{**}
	(0.052)	(0.051)	(0.051)	(0.049)
$MERGE(3)$	0.105	0.083	0.082	0.111
	(0.207)	(0.208)	(0.208)	(0.208)
Year dummies	Yes	Yes	Yes	Yes
Number of observations	5,009	5,009	5,009	5,009
Number of industries	594	594	594	594
Log likelihood	$-2,940$	$-2,914$	$-2,913$	$-2,909$
Wald χ^2	315^{***}	352^{***}	353^{***}	365^{***}
LR χ^2 ($\rho = 0$)	322^{***}	261^{***}	259^{***}	251^{***}

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Wald χ^2 is the statistic to test the null hypothesis that all the coefficients equal 0. LR χ^2 is the statistic to test the null hypothesis that $\rho = 0$ where ρ is the proportion of the total variance contributed by the panel-level variance component.

Table 6. Ordered estimation results for the turnover of the top three firms: Z

Variable	(i) Coef.	(ii) Coef.	(iii) Coef.	(iv) Coef.
HHI	-3.776^{***}	-3.855^{***}	-4.191^{***}	
	(0.415)	(0.407)	(0.462)	
H_HHI				-0.949^{***}
				(0.103)
$GROW$	-0.004			
	(0.134)			
$GROW\_SQ$	0.479^{***}			
	(0.102)			
$GROW\_P$		1.689^{***}	1.301^{***}	1.217^{***}
		(0.243)	(0.470)	(0.312)
$GROW\_N$		-1.472^{***}	-0.966^{**}	-0.850^{***}
		(0.204)	(0.398)	(0.246)
$HHI \times GROW\_P$			1.580	
			(1.662)	
$HHI \times GROW\_N$			-2.227	
			(1.561)	
$H\_HHI \times GROW\_P$				0.989^{**}
				(0.476)
$H\_HHI \times GROW\_N$				-1.445^{***}
				(0.391)
RD	15.625^{***}	15.041^{***}	14.985^{***}	15.329^{***}
	(2.225)	(2.155)	(2.153)	(2.140)
$CARTEL$	-0.562^{*}	-0.587^{**}	-0.577^{**}	-0.519^{*}
	(0.288)	(0.283)	(0.282)	(0.280)
$IMPORT$	-0.574	-0.742^{*}	-0.700	-0.215
	(0.448)	(0.442)	(0.442)	(0.430)
$SIZE$	-0.178^{***}	-0.156^{***}	-0.150^{***}	-0.098^{**}
	(0.048)	(0.046)	(0.046)	(0.045)
$MERGE(3)$	0.175	0.146	0.150	0.165
	(0.189)	(0.189)	(0.189)	(0.188)
Year dummies	Yes	Yes	Yes	Yes
κ_1	-1.252^{**}	-0.893	-0.898	0.191
	(0.601)	(0.587)	(0.587)	(0.549)
κ_2	-0.473	-0.110	-0.115	0.972^{*}
	(0.600)	(0.586)	(0.586)	(0.549)
κ_3	0.080	1.055^{*}	1.049^{*}	2.131^{***}
	(0.600)	(0.586)	(0.586)	(0.550)
Number of observations	5,009	5,009	5,009	5,009
Number of industries	594	594	594	594
Log likelihood	$-5,070$	$-5,039$	$-5,038$	$-5,043$
Wald χ^2	375^{***}	433^{***}	434^{***}	429^{***}
LR χ^2	332^{***}	266^{***}	263^{***}	261^{***}

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Wald χ^2 is the statistic to test the null hypothesis that all the coefficients equal 0. LR χ^2 is the statistic to test the null hypothesis that the estimates using a random-effects ordered logit model does not differ from those using a standard ordered logit model.

Table A1. Marginal effects: $Y(1)$, $Y(2)$, and $Y(3)$

	$Y(1)$		$Y(2)$		$Y(3)$	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Variable	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
HHI	−0.505***	−0.522***	−0.709***	−0.716***	−0.758***	−0.764***
	(0.065)	(0.064)	(0.082)	(0.080)	(0.090)	(0.087)
$GROW$	−0.059		3.6×10^{-5}		0.014	
	(0.013)		(0.025)		(0.033)	
$GROW\_SQ$	0.050***		0.088***		0.078***	
	(0.010)		(0.019)		(0.024)	
$GROW\_P$		0.140***		0.283***		0.385***
		(0.023)		(0.045)		(0.065)
$GROW\_N$		−0.138***		−0.253***		−0.293***
		(0.020)		(0.039)		(0.052)
RD	1.069***	1.003***	2.694***	2.551***	3.674***	3.503***
	(0.249)	(0.242)	(0.410)	(0.395)	(0.487)	(0.469)
$CARTEL$	−0.070	−0.075*	−0.059	−0.061	−0.131**	−0.135**
	(0.043)	(0.042)	(0.054)	(0.053)	(0.065)	(0.063)
$IMPORT$	−0.054	−0.072	−0.139*	−0.167**	−0.136	−0.173*
	(0.047)	(0.047)	(0.084)	(0.082)	(0.103)	(0.101)
$SIZE$	−0.022***	−0.021***	−0.024***	−0.021**	−0.035***	−0.031***
	(0.005)	(0.005)	(0.009)	(0.009)	(0.011)	(0.010)
$MERGE(k)$	0.048	0.048	0.063	0.060	0.022	0.017
	(0.032)	(0.032)	(0.042)	(0.042)	(0.044)	(0.043)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	5,009	5,009	5,009	5,009	5,009	5,009
Number of industries	594	594	594	594	594	594

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. $MERGE(k)$ indicates $MERGE(1)$, $MERGE(2)$, and $MERGE(3)$ for $Y(1)$, $Y(2)$, and $Y(3)$, respectively. The marginal effects are computed on the probability of a positive outcome assuming that $\mu_i = 0$.