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Horizontal Transfer and Promotion: New Evidence and an Interpretation from the Perspective of Task-Specific Human Capital

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【要約】This paper provides new evidence about horizontal transfer and promotion using the largest available personnel panel data in Japan and interprets them from the perspective of task-specific human capital. We find that firms synchronize their employees' promotion and horizontal transfers. Then, we show theoretically that task-specific human capital can naturally generate such synchronization. We also find that the directors in an accounting department have the highest probability of being promoted to become board members, while those in a research department have the lowest. This suggests that top managers need a balanced skill set, in which allocative skill is relatively important.

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1. Introduction

The internal labor market has been widely investigated since Doeringer and Piore (1971) described the characteristics of an internal labor market quite differently from those of an external labor market. Many theories have been proposed and more evidence has been accumulated, but there are still many unexplored aspects of internal labor markets.

The relationship between horizontal transfer and promotion is one of them. Although several excellent surveys of internal labor markets have been published, they typically do not deal with horizontal transfers [e.g., Lazear (1998), Gibbons and Waldman (1999b) and Lazear and Oyer (2007)]. Knowing that there are frequent horizontal transfers in reality, this lack of attention to them by academics is surprising. One possible reason is the lack of suitable data. Data on internal labor markets are typically confidential, and it is not easy to access data that describe individual movements across several functional departments. Without reliable evidence, it is conceivable that economists find it difficult to develop a reasonable theory on horizontal transfers.

In fact, the relationship between horizontal transfer and promotion is likely to provide useful information on the benefits and costs of skills acquisition. On one hand, as horizontal transfers lead to the acquisition of multitask skills, the observed career path should be designed to acquire the necessary task-specific skills after promotion. Hence, we may possibly obtain information on the types of skills required of top managers. On the other hand, as the reallocation of workers across jobs is accompanied by reallocation costs, observed career paths must be designed to save such costs. As the loss of skills inherent in reallocation across jobs is likely to be a main candidate for the costs of reallocation, investigation of

the interaction between horizontal transfer and promotion should provide useful information on the transferability of skills across jobs.

This paper provides new evidence on the relationship between horizontal transfer across functional departments and vertical promotion using the largest personnel panel data set in Japan. In order to obtain coherent information from that data, this paper adopts, as a conceptual framework, the notion of task-specific human capital, the importance of which is emphasized by Gibbons and Waldman (2004, 2006). They conjectured that the reason firms employ job rotation is to minimize the underutilization of task-specific human capital when promotions take place. However, because they do not have any evidence about horizontal transfers, their formal model in Gibbons and Waldman (2006) is designed to explain evidence about promotion without horizontal transfer and, therefore, their modeled task-specific human capital cannot be distinguished from rank-specific human capital. This paper shows that the difference between task-specific human capital and rank-specific human capital is important in understanding evidence on the relationship between horizontal transfer and vertical promotion.

Four findings are worthy of special mention. Firstly, we find that there is a robust correlation between the timing of promotion and horizontal transfer. Eriksson and Ortega (2006) identify three promising theories of horizontal transfer: horizontal transfer makes employees acquire multitask skills, helps employers learn about employees' abilities, and mitigates boredom. Ariga (2006) points out that job creation and destruction can influence the pattern of horizontal transfer. However, none of these theories can explain the synchronization of decisions.

We construct a model that shows that the synchronization of promotion and horizontal transfer occurs if and only if the reallocation cost is strictly submodular with respect to vertical promotion and horizontal transfer. In order to derive an

economic interpretation of this result, we also provide a theoretical basis for the submodular cost function from the perspective of task-specific human capital. This shows that the reallocation cost resulting from the accumulation of the task-specific skills required for a new position is in general submodular, and that it is strictly submodular if and only if there is duplication of new tasks required for the new functional department and ranked position. Through the lens of this theory, the synchronization of the promotion decision and the horizontal transfer decision can be interpreted as a practice to save the reallocation costs that arise from the duplication of the required tasks.

Note that the strict submodularity of the reallocation cost function cannot be derived from department-specific human capital and rank-specific human capital because it must have common tasks and therefore common skills between functions and ranks. Therefore, only task-specific human capital can explain the evidence.

Secondly, we find that directors are more frequently transferred to other functional departments than section managers. Task-specific human capital can also explain this evidence. We show theoretically that if the marginal benefits from multitask skills are larger for directors than for section managers, the higher-ranked managers are more likely to be transferred to other functional departments.

Thirdly, we find that directors who belong to an accounting department have the highest probability of being promoted to board membership, while those who belong to a research department have the lowest. In particular, even after controlling for the measure that is likely to be correlated with unobserved ability, those department dummy variables never lose their significance. Note that there is no other hierarchical position in between directors and board members. Hence, if skills accumulated during directorships are needed after promotion, the theory

of task-specific human capital predicts that there must be tasks that are common between directors and board members. That is, our findings provide useful information on skills that are relatively important for top managers. With the assistance of several theories of entrepreneurial ability [e.g., Schultz (1975), Takii (2003) and Lazear (2005)], we interpret our evidence that top managers need balanced skill sets with relatively large weighting on their allocative skills.

Fourthly, we also find that once we restrict our attention to relatively large firms, not only the coefficient of the accounting department dummy on promotion but also that of the personnel department dummy retain their significance after controlling for the proxies of unobserved ability. This is interesting, because the large role of personnel departments is likely to be specific to Japan. Jacoby (2005) points out that, compared with U.S. companies, human resource staffs are centralized and conduct organization-oriented employment decisions in Japan, and human resource departments rank relatively highly in the corporate hierarchy. Knowing that the role of the personnel department is more than just allocating workers, evidence indicates that not only allocative ability but also the ability to supervise workers to maintain Japanese employment practices is an important skill for top managers in Japan's large companies.

Several previous papers have empirically investigated internal labor markets. Although the majority of papers focus on promotion (e.g., Rosenbaum (1984), Baker, Gibbs and Holmstrom (1994a, 1994b) and Ariga, Ohkusa and Brunello (1999)), as horizontal transfer is a common practice in the major companies in Japan, Japan's labor economists accumulate relatively more evidence on horizontal transfer. Among them, Koike (1991) proposed an influential hypothesis. Koike argues that the breadth of horizontal transfers measures the level of 'intelligent skill', which is needed to deal with uncertainty. Following this Koike

hypothesis, many Japanese economists examine the breadth of horizontal transfer (e.g., Kakizawa et al. (2004)) and its effect on promotion (e.g., Ariga (2006)), based on evidence from a single firm or questionnaires from a small sample. In contrast to these papers, this paper focuses on the skills that are relatively important for top managers, and on the cost of acquiring multitask skills, based on a representative sample of relatively upper-level managers in Japanese companies.

Although most empirical studies on the internal labor market are based on case studies or questionnaires from a small sample, Eriksson and Ortega (2006) is a notable exception. They conduct a firm-level analysis using a large employer–employee matched data set in Denmark. Our personnel data set is based on questionnaires from all publicly traded companies and many privately owned companies in Japan. It covers all board members in publicly traded companies and a large sample of directors and section managers. Hence, we can demonstrate the average features of Japan's internal labor market for relatively upper-level managers. Using the advantages of the unique data set we have not seen elsewhere, we conduct an individual-level analysis and provide more detailed information on the relationship between promotion and horizontal transfer. Hopefully, our evidence nicely complements the existing case studies.

Finally, several recent papers point out the importance of task-specific skills. Lazear (2009) derives a firm-specific human capital as a firm-specific combination of task-specific human capital and discusses why firms pay for the cost of skill accumulation that do not appear to be firm specific. Geel, Mure and Backes-Gellner (2008) provide evidence that supports the prediction of Lazear's model. Gathmann and Schönberg (2007) measure the level of task-specific human capital and show empirically that task-specific human capital is an important determinant of wage growth and occupational mobility. Unlike these papers, we use the model

of task-specific human capital as a device to obtain coherent information from our data. We also show that task-specific human capital can generate synchronized decisions on promotion and horizontal transfer. We believe that our theory and evidence is complementary to theirs.

The paper is organized as follows. The next section overviews features of internal labor markets in Japan. The third section explains our data set. The fourth section compares our data set with publicly available aggregate statistics to examine potential biases due to sample selection. The fifth section investigates career paths when managers are section managers or directors. We pay special attention to the timing of promotion and horizontal transfer, and show robust evidence that the timing is fairly closely correlated. We also provide our explanation for the synchronized decisions from the perspective of task-specific human capital. The sixth section investigates the probability of promotion from director to board member. In particular, we are interested in how the likelihood of promotion to board membership depends on the department where they were a director. We provide robust evidence that being in an accounting department has the strongest impact on the promotion, and discuss a possible interpretation of our finding. The final section concludes and discusses future extension of the research.

2. The Internal Labor Market in Japan

Japan's labor market is said to be unique. Milgrom and Roberts (1992) describe common views on human resource practices in major Japanese firms: long-term employment guarantees, and recruiting of permanent employees at early stages of their careers. Ariga, Brunello and Ohkusa (2000) characterize several features

of the internal labor market in large Japanese firms as having (1) seniority-based promotion and a late selection approach, (2) centralized allocation of workers to jobs, (3) extensive job rotation and internal transfers, and (4) well-defined ports of entry and a strong preference for recruitment of those have just left school without having been employed elsewhere . Finally, as Kaplan (1994) documents, it is also well known that the majority of board members in Japanese companies are selected from inside the companies and that most CEOs are chosen from among board members.

These features of the Japanese data give us several advantages. Firstly, long-term employment guarantees can mitigate an attrition bias due to turnover. Our data set is based on questionnaires to major companies in Japan. Therefore, we lose observations when an employee quits those companies. Although there may be concern about possible selection bias, the relatively low turnover rate of middle managers in Japan makes it possible to believe that the bias is fairly small. Secondly, centralized allocation of workers to jobs means that observing reallocation of employees inside a firm allows us to infer intended strategies held by the firm. In particular, if horizontal transfer is a way to accumulate skills needed after promotion, and a firm tries to save the cost inherent in the reallocation of employees, the firm's intentions should be reflected in the data.

Of course, this unique feature of Japan's labor market is likely to influence some dimensions of the statistics. Koike (2002a) compares the career paths of white-collar workers in companies in Japan, the U.S., England and Germany, and summarizes three unique features of internal careers in Japan: (1) Japanese career paths in a firm are relatively broader than in other countries, (2) while most promotion is from inside firms in Japan, more managers are employed from outside in other countries, and (3) the Japanese promotion system is relatively

slow. Jacoby (2005) compares Japan's internal labor market with the U.S. internal labor market and points out the stronger role of personnel departments in Japan.

As we discuss later, we can confirm some of these features from our data: the speed of promotion is still slow, and there are relatively high promotion probabilities from personnel as well as accounting departments to board membership in relatively large firms. After experiencing a burst bubble, Japanese life-long employment practices are now often accused of being inflexible and in need of restructuring. Interestingly, our observations indicate that employment practices in Japan have not changed much, even after several critiques of the employment system.

Nonetheless, this uniqueness does not mean that the lessons from the Japanese internal labor market are irrelevant to other countries. Koike (2002a) also points out some common features of the internal careers of white-collar workers: (1) in all countries, workers spend most of their careers in a functional department, and (2) on-the-job training (OJT) plays a major role in skills acquisition. Because OJT plays a major role in skills acquisition, it is necessary for top managers to acquire multitask skills, and firms in most countries must face similar problems: how to economize on reallocation costs. Therefore, at least the *qualitative* relationship between promotion and horizontal transfer is less likely to be specific to Japan.

3. Data Description

Our personnel data are based on the information files for board members, regardless of representation rights, directors (Bucho) and section managers (Kacho) collected by Diamond Inc.. Diamond Inc. sells its files to customers who need them for a variety of reasons: developing marketing strategies, maintaining cus-

tomer information or sending direct mail to the relevant personnel in a company. We obtained the historical data in this file from 1998 to 2005, which comprises our unbalanced panel data.

As our data were not originally designed for research purposes, we need to take particular care in our use of the data. After reading various documents, we conducted an interview with an editor in chief at the editorial department in the information service office of Diamond Inc. In order to investigate the representativeness of the data, we also compare the aggregate statistics constructed by our data set with the aggregate statistics based on the Basic Survey on Wage Structure (BSWS hereafter), which is released by the Ministry of Health, Labour and Welfare (MHLW hereafter). In this section, we first describe features of the data revealed by the documentation and our interview. In the next section, we describe the results of our comparison of the aggregate statistics sets.

Diamond Inc. sends out its questionnaire to the general affairs department or personnel department of companies once a year, and collects information for board members, directors and section managers. It also collects data from several press releases to maintain up-to-date information. According to the chief editor, 80 percent of publicly traded firms reply to their questionnaires. If they do not receive any response from a firm, they fill out part of the questionnaire from that firm's financial reports. As board members in the publicly traded companies are obligated to reveal their names, our data set contains all board members of publicly traded companies.

It also covers many nonlisted companies. According to the chief editor, although the precise criteria for sending a questionnaire change slightly over time, they send them to all relatively large companies. For example, in 2006, Diamond Inc. sent a questionnaire to nonlisted companies that had more than 100 employ-

ees and capital stock (Shihon Kin) of more than 30 million yen. In total, the data set contained about 14,000 companies in September 2006. Hence, it covers most of the major companies in Japan.

We initially wondered why so many firms had an incentive to answer the questionnaire, and suspected that there might have been some monetary compensation. However, the editor in chief denied our presumption, and insisted that firms were not motivated by any monetary incentive. According to him, as Diamond Inc. has provided personnel information since 1935**,** many firms consider being listed in the data set as prestigious. He conjectured that the prestige of their products would be the reason for many records.

Another advantage of this information file is that it contains information on directors and section managers. Hence, we can potentially examine the average career patterns for relatively upper-level managers in Japan.

Unfortunately, the disclosure of information is not mandatory, and the disclosure strategies of firms are not well specified. The presumption for our analysis is that their disclosure strategies are independent of unobserved characteristics of individuals that can influence the speed of promotion and the probability of transfer to another department. Several assignment theories (e.g., Waldman (1984)) suggest that firms have incentives to hide information on the talents of their workers so that outside firms cannot make selective offers to the more talented workers. If these theories are correct, because the disclosure policies of firms that reflect their evaluations of their workers reveal information about the unobserved abilities of their workers, we expect that the disclosure policies of the firms should be independent of their evaluations of their workers. The interview with the editor in chief roughly confirmed our presumption. According to him, each firm has its own policy about how willing they are to reveal their information, and firms routinely

answer the questionnaire every year based on their specific policies. Although relatively larger and more traditional firms tend to disclose more information, he did not think that firms' disclosure strategies depended on unobserved individual characteristics. He also said that because employees themselves can access their own information, if firms' disclosure strategies depended on unobserved individual characteristics, the firms' disclosure decision could cause the employees some concern.

In order to check the validity of his statement, we checked potential bias by comparing the aggregate statistics constructed from our data set with the aggregate statistics based on BSWS in the next section.

4. Comparison between Diamond Survey and Basic Survey on Wage Structure

In order to understand a potential bias inherent in the Diamond survey, we compared the aggregate statistics of the Diamond survey with those of the BSWS. In this section, we briefly explain the notable characteristics of the Diamond survey, and have placed more detailed information in the Appendix.

The BSWS aims to obtain a clear picture of the wage structure of employees in major industries. The MHLW sends the survey to randomly selected establishments every year from July 1st to July 31st. Establishments are selected by a uniform sampling method from establishments (private establishments and establishments of public corporations) with 10 regular employees or more and private establishments with 5 to 9 regular employees. Then, the employees are selected by a uniform sampling method from the selected establishments. The BSWS contains information on directors (Bucho) and section managers (Kacho). The

MHLW provides the age distribution and the length of tenure by industry and the size of firms. We use this aggregate data to assess the potential biases of the Diamond survey.

During our investigation, we realized that age distributions in the manufacturing sector in the two data sets were relatively similar, while there were some notable differences in other industries. Hence, we decided to use only the manufacturing sector for our investigation.

The BSWS was conducted as of June 30th for facts in fixed time such as age and tenure. On the other hand, the Diamond survey updates an individual's record every time there are press releases, and we often observed that the record was updated more than once within one year. To create yearly-based panel data, we picked up information on the individual as of August every year. The Diamond survey collects questionnaires from all publicly traded companies between June and August of each year, and roughly 62 percent of data is updated in July or August. Hence, we aggregated the Diamond survey at the end of August, which roughly corresponds to the information around June.

Because the instructions on the BSWS state that deputy managers of a department (ji-cho) are not included in either directors or section managers, we also excluded deputy managers of a department for the purpose of this comparison[1]. However, as there is no economic reason to exclude deputy managers of a department from our analysis, we include them in the directors' group for our analysis in the following section. The BSWS instructions also suggest that when an employee is both a director and a board member, he is treated only as a director. The

[1] Including deputy managers of a department in section managers or directors does not change the results of a comparison between the two data sets. Estimation results are available upon request.

Diamond survey identifies the main and secondary positions for each respondent separately. We considered a person as a director only when a company reported that his main position was as a director[2].

Because the BSWS reveals information only for male managers, we compare data for male managers. Because female managers are scarce, this does not reduce the number of observations very much. We also drop samples that show logically inconsistent observations: one who is less than 15 years old, has a negative value of tenure, and starts a job when their age is less than 15. These data selection processes eliminate 18.14 percent of data.

Figure 1 shows the ratio of the number of directors and section managers in the Diamond survey to that in the BSWS. Because the number appearing in the BSWS is the estimated population, figures show the estimated proportion of directors and section managers that the Diamond survey actually covers.

There are three notable features of the Diamond survey. Firstly, there is large coverage of male directors in the manufacturing sector. In particular, even after data selection for our analysis, it covers 60 percent of male directors in companies with more than 1000 regular employees until 2000.

Secondly, the coverage gradually declines, especially in large companies. During this period, Japanese society was quite sensitive regarding the protection of personal information. In order to introduce the Basic Resident Register Network in 2002, the protection of privacy became a political issue. In addition, several information leakages occurred in this period. In the end, the Diet passed a personal information protection law in 2003. This change in public opinion is likely to reduce the number of responses to the Diamond survey. However, it should

[2]Including secondary positions does not influence the results from the comparison of the two data sets.

be noted that the Diamond survey still covered more than 10 percent of directors in Japan in 2005. Hence, this is still the largest data set we can obtain for the analysis of upper-level managers' careers in Japan.

Finally, the number of directors is much larger than the number of section managers. It indicates that most firms have strategies to reveal more information for higher-ranked managers. As the data do not show the hierarchical structure that is typical of most organizations, these data are not suitable for examining the structure of firms.

In order to understand the features of the Diamond survey in detail, we investigate the ratio of the number of directors and section managers in the Diamond survey to that in the BSWS by age group. In order to save space, we discuss only the data for 1998 and 2005, but similar results are obtained in other years[3]. Figure 2 shows that the response rate is roughly the same between ages 40 and 60, while it is fairly high for other age groups. As shown below, the majority of directors and section managers are aged between 40 and 60. Hence, this unaccountable feature of the data is less likely to influence the analysis below, although in order to check the robustness of our results, we also conduct our analysis using the subsample covering ages 40 to 60.

We compare the age distribution and the length of tenure by age group in both data sets by a firm size. Because we obtain similar results in other years, we again report only the results in 1998 and 2005[4]. Note that the response rate is highest in 1998 and lowest in 2005. Hence, the deviation of the Diamond survey from the BSWS is smallest in 1998 and largest in 2005. Figure 3 shows the results.

[3]The results in other years are reported in figures A-1 to B-6 of the Appendix.

[4]The results for the other firms in other years are reported in figures C-1 to H-6 in the Appendix.

Despite several differences between the Diamond survey and the BSWS, the age distribution and the length of tenure by age group in both data sets are quite similar. In particular, the age distribution in 1998 is almost identical in any firm size groups. Although some notable differences between the Diamond Survey and the BSWS appear in 2005, the age distribution in the Diamond Survey still broadly captures the respective age distributions in 2005. We can also find some differences in the length of tenure after the age of 60. However, the overall picture is the same before the age of 60.

Note that the similarity of the age distribution and the length of tenure by age group holds, even though there is no clear-cut definition of directors (Bucho) and section managers (Kacho). The Diamond Inc. itself classifies several categories of positions into directors and section managers, while in the BSWS, each establishment is asked to classify them. As there is no objective definition of directors and section managers, some classifications are influenced subjectively. Nonetheless, the similarity of age distribution and length of tenure suggests that there are some common views on these hierarchical ranks. This means that there is some merit in statistically investigating hierarchical ranks in an economy.

In summary, the Diamond survey captures the overall picture of age distribution and length of tenure by age very well, at least for a carefully chosen subsample. This observation is consistent with one of our presumptions, namely that the firm's disclosure strategy is independent of unobserved individual characteristics. Knowing that this is the largest currently available data set that contains information on careers for upper-level managers, it is worth extracting information from this data set, albeit with some caution.

5. From Section Managers to Directors

In this section, we first analyze the relationship between horizontal transfer and promotion when managers are section managers or directors. Let us first describe the simple summary statistics for the speed of promotion to become a director, the transition matrix across functional departments and the breadth of job transfer across functional groups.

Table 1 shows the average tenure and age when employees are promoted to become a director. It shows that the average tenure is roughly 24 years and the average age is 48 years when employees are promoted to directorships in Japan. These numbers roughly confirm the standard view that the speed of promotion in Japanese firms is slow. Table 1 also shows that the average tenure and the average age do not change over time. Because we know the composition of firm size changes in our sample, we also report the average tenure and the average age for firms with 1000 or more employees. Observing that the average age and tenure remain unchanged using the sample of large firms, the selection problem seems minimal. Hence, slow promotion is less likely to be the result of sample selection.

In order to investigate horizontal transfers, we categorize departments into nine functional groups: general affairs & press, personnel, accounting, planning, international affairs, research & development, production, sales and others. Table 2 and Table 3 show the transition probabilities across functional groups between the previous year and the current year. Table 2 shows the transition probability matrices when section managers and directors are not promoted; Table 3 shows the matrix for when section managers are promoted to become directors.

The prominent feature of the transition matrixes is that the diagonal of the

matrix is fairly large. This means that transition across functional groups does not occur frequently. This is consistent with Koike's observation that employees spend most of their careers in one functional group (2002a).

More importantly, a comparison of Table 2 and Table 3 reveals a notable difference: the transition across functional departments increases at the same time that employees are promoted. That is, the promotion and horizontal transfer decisions are synchronized.

In order to quantify the magnitude of the difference, we construct a measure of the average breadth of a job transfer across functional departments. We define the breadth of job transfers across functional groups at company j as follows:

$$Breadth_j = 1 - \sum_{i}^{9} share_i P\left(f_{j,+1} = i | f_j = i\right)$$

where $P\left(f_{j,+1} = i | f_j = i\right)$ is the probability of having a job in functional group i at company j in the next year when one currently has a job in the same functional group at the same company, and $share_i$ for $i = 1...9$ represents the distribution of section managers (or directors) among functional departments. The average breadth of job transfer is a weighted average of this breadth measure across companies with the number of observations as its weight. This measure can be interpreted as the average probability of being transferred to a different functional group.

Table 4 shows our measure of the average breadth. It shows that when they are section managers (directors), only 11 (17) percent of employees are transferred to other functional departments; when employees are promoted from section managers to become directors in a year, 33 percent of employees experience job transfers. Hence, the transition probability to a different functional group is

two or three times larger when they are promoted. That is, a firm synchronizes its promotion and transfer decisions. Note that the result is also robust across years, implying that it is less likely to be the result of measurement error.

Interestingly, the measure of average breadth also reveals that directors are more likely to be transferred to other functional departments than section managers. It indicates that when there is no promotion, higher-ranked managers are more likely to be transferred to other functional departments.

Because these observations are not emphasized in previous literature, it is worth scrutinizing them more closely. Firstly, we examine whether location changes may influence the measure of breadth. We split the sample by whether employees move from headquarters to headquarters, from branch to headquarters, from headquarters to branch or from branch to branch, and estimate our measure of average breadth by each subsample. The results are also reported in Table 4**.** This shows that the overall picture does not change across subsamples. It shows that the probability of being transferred to other functional departments when employees are promoted from section managers to become directors is still two or three times larger than when they stay as section managers (when they stay as directors) in all samples. This indicates that location changes have little effect on the frequency of horizontal transfers.

We also investigate whether controlling several observable characteristics of employees and firms eliminates the results. For this purpose, we investigate the following random logit model. We assume that horizontal transfer occurs between $t+1$ and t if and only if $y_{tj} \geq 0$ where y_{tj} is an unobserved latent variable of jth individuals at year t. We also assume that y_{tj} is determined by:

$$y_{tj} = \alpha_0 + \alpha_p I\left(promotion\right) + \alpha_d I\left(directors\right) + \beta' x_{tj} + \gamma_t + \gamma_j + \varepsilon_{tj}$$

where $I\,(promotion)$ ($I\,(directors)$) is 1 when the promotion occurs (an employee is a director) and 0 otherwise, x_{tj} is a vector of observed characteristics of jth individuals at year t, γ_t is a year dummy, γ_j is an unobserved individual specific factor that is independently identically normally distributed with mean 0 and variance σ_γ^2, and ε_{tj} are independently identically Gumbel distributed. The control variables include individual characteristics such as tenure, experience at other companies and education dummies, the characteristics of the firm to which the individual belongs, such as the dummy for listed companies, firm size and the two-digit classification of manufacturing industry, and year dummies. The details of the control variables are explained in the Appendix.

Table 5 reports the result of the random logit model. It shows that the promotion dummy is positive and significant, which suggests that there are some unobservable reasons for the synchronization of promotion and horizontal transfer[5]. It also shows that the director dummy is also positive and significant, although the coefficient is much smaller than that of the promotion dummy. We also conduct two robustness checks. Firstly, because we know that data would be more reliable between ages 40 and 59, we only use data for this age group and conduct the same regression analysis. Secondly, because there are gradual reductions in the response rate in our sample over time, we also conduct the same regression using the subsample that contains a relatively high response rate: between 1999 and 2002. The second and third columns in Table 5 show the results of these robustness checks. This shows that the coefficient and significance of the promotion dummy and the director dummy do not change very much, which

[5]Here, we pay attention to the synchronization of promotion and horizontal transfer, but not the causality. Therefore, we have no intention of claiming from this evidence that the promotion decision causes horizontal transfer.

confirms that firms synchronize their promotion decisions and horizontal transfer decisions and that higher-ranked managers are likely to be transferred to other functional departments.

A Formal Model to Explain the Evidence: Now we are ready to formalize our explanation of the evidence. Suppose that the order of functional transfers is exogenously given. For example, a firm might decide to transfer a worker with experience in the sales department to the planning department. If a firm uses the transfer as a means of building its workers' multiple job experience, the sequence of transfers must be designed to achieve the accumulation of skills. Our assumption means that we take this sequence as exogenously given. This assumption can be relaxed, but greatly simplifies our notation. Let i denote the ith functional department to which a worker is transferred. This means that i also measures the amount of multitasking an employee obtains by working in different functional departments.

Suppose that when employees with characteristics x and i functional experiences produce $y(r,i,x)+\varepsilon(r,i)$, $r \in \{s,d\}$ when they are section managers, s, or directors, d and $y(b,i,x)+\varepsilon(b)$ when they are board members. It is assumed that $\varepsilon(s,i)$, $\varepsilon(d,i)$ and $\varepsilon(b)$ are independently identically Gumbel distributed. This random variable captures the demand effects on promotions and horizontal transfers suggested by Ariga (2006). The vector, x, can include observable variables for individual characteristics, firm characteristics and time dummies. We assume that x evolves through the function $x' = g(x,u)$ where u is some stochastic factor. These dynamics allow human capital accumulation through experience and employer learning about the ability of employees. Hence, the model by Gibbons and Waldman (1999a) can be consistent with this model.

Suppose that both promotion and horizontal transfer of section managers and directors are accompanied by reallocation costs, $C(p, h)$, where p means the decision on promotion and h means the decision on horizontal transfer. Both p and h are 0 or 1, where 0 means that workers stay in the same position and 1 means that workers move to new positions. The reallocation cost from directors who belong to the ith functional department to board members is given by $C_b(i)$.

We assume that wage payments can be negotiated in each period without any transaction costs. Therefore, the Coase theorem suggests that we can focus on Pareto optimal reallocation of employees without questioning who makes a decision. Hence, without loss of generality, we assume that a firm makes the reallocation decision and maximizes the total surplus between a firm and an employee.

After producing output, a firm must decide whether the section manager should stay in the current position, move to another functional department as a section manager, be promoted to become a director of the same functional department, or be promoted to become a director of another functional department. Similarly, after producing output, a firm must decide whether the director should stay in the current position, move to another functional department as a director, or be promoted to board membership. Let $\beta(x) \in (0, 1)$ for all x denote a discount factor, which is a mixture of a standard discount factor and the probability of employees staying in this firm. We allow that the probability of staying in the firm can be a function of x.

We assume that the reservation values of both employees and the firm are 0. Then, the present value of the stream of the total surplus from employing section managers, directors and board members with i different department experience, $W(s, i, x)$, $W(d, i, x)$ and $W(b, i, x)$, are expressed by the following Bellman equa-

tions:

$$W(s,i,x) = y(s,i,x) + \varepsilon(s,i) + \beta(x) \int V(s,i,x')\, dF_s(\{\varepsilon(r,j)\}, u),$$

where $V(s,i,x') = \max \left\{ \begin{array}{c} W(s,i,x') - C(0,0), W(s,i+1,x') - C(0,1), \\ W(d,i,x') - C(1,0), W(d,i+1,x') - C(1,1) \end{array} \right\}$, $r \in \{s,d\}$ and $j \in \{i, i+1\}$, and

$$W(d,i,x) = y(d,i,x) + \varepsilon(d,i) + \beta(x) \int V(d,i,x')\, dF_d(\{\varepsilon(d,j)\}, \varepsilon(b), u)$$

where $V(d,i,x') = \max\{W(d,i,x') - C(0,0), W(d,i+1,x') - C(0,1),\ W(b,i,x') - C_b(i)\}$ and $j \in \{i, i+1\}$, and

$$W(b,i,x) = y(b,i,x) + \varepsilon(b) + \beta(x) \int W(b,i,x')\, dF_b(\varepsilon(b), u).$$

The cost $C(0,0)$ can be 0, but it does not have to be. It can be interpreted as the cost of maintaining the current skill.

Let $P_{ss}(i+1|s,s,i)$ $P_{sd}(i+1|d,s,i)$ and $P_{dd}(i+1|d,d,i)$ denote the probability of moving to another functional department when section managers are not promoted, when section managers are promoted to become directors and when directors are not promoted, respectively. Then, we can prove the following theorem. The proof is established in the Appendix.

Theorem 1. *The probability of being transferred to another functional department is larger when promotion occurs than when employees are directors if and*

only if the reallocation cost is strictly submodular with respect to promotion and horizontal transfer:

$$P_{dd}(i+1|d,d,i) < P_{ds}(i+1|d,s,i), \ iff \ C(0,0)+C(1,1) < C(0,1)+C(1,0).$$

Suppose that the marginal benefits from multitask skills are larger for directors than for section managers, $y(d,i+1,x)-y(d,i,x) > y(s,i+1,x)-y(s,i,x)$. *Then, there exists* $\beta^* \in (0,1)$ *such that for all* $\beta(x) \leq \beta^*$, *the probability of being transferred to another functional department is larger when employees are directors than when they are section managers:*

$$P_{ss}(i+1|s,s,i) < P_{dd}(i+1|d,d,i).$$

The second part of theorem 1 shows how multitask skills influence the differences in the transfer probability of directors and section managers. When additional new functional experience is more valuable for directors than for section managers, unless the discount factor is too big, the probability of changing functional departments should be higher for directors than section managers.

More importantly, the first part of theorem 1 derives the condition that the synchronization of promotion and horizontal transfer does occur. The intuition behind these results is as follows. Suppose that $y(r,i,x) = y$ and that there is no cost of maintaining skills, $C(0,0) = 0$. In this case, the random realizations of $\{\varepsilon(d,i)\}$ are the only reason for the reallocation of employees. If a section manager in a functional department i is transferred to a functional department $i+1$ without promotion, the reallocation cost is $C(0,1)$; if a section manager in a functional department i is transferred to a functional department $i+1$ as

a director, the reallocation cost is $C(1,1)$. Note that when a firm decides that an employee should be promoted, the firm has in effect already decided to pay the reallocation cost of $C(1,0)$. Hence, the additional cost for transferring the employee to the other functional department is $C(1,1) - C(1,0)$. The theorem shows that synchronized decisions are likely to occur if and only if the additional cost of reallocation is larger when section managers are not promoted than when they are promoted, $C(0,1) > C(1,1) - C(1,0)$.

Micro Foundation of Submodular Reallocation Cost Function: Evidence suggests that transportation costs are unlikely to be the source of the reallocation cost. We conjecture that the cost accompanying skills accumulation is an alternative candidate. We provide a theoretical basis for the submodular cost function from the perspective of task-specific human capital.

Let $\left(Y, \Theta, \hat{C}\right)$ be a measure space where Y is a set, Θ is a $\sigma-$algebra of its subsets, and $\hat{C}$ is a measure defined on Θ. We assume that the measure $\hat{C}(H)$ where $H \in \Theta$ represents the cost of acquiring skills in a task set H. Let $H_r \in \Theta$ and $H^j \in \Theta$ denote the set of tasks required to perform a job at rank $r \in \{s, d\}$ and in functional department $j \in \{i, i+1\}$, respectively.

Suppose that an employee is currently assigned to a functional department $j = i$ as a section manager $r = s$ and obtains all the skills corresponding to the tasks in $H_s \cup H^i$. Let $H^n(p,h) \in \Theta$ denote the set of new tasks needed to perform new jobs, where $p \in \{1,0\}$ means the decision on promotion and $h \in \{1,0\}$ means the decision on horizontal transfer, where 0 means that workers stay in the same position and 1 means that workers move to a new position. Therefore, $\hat{C}(H^n(p,h))$ represents the cost of acquiring the task-specific skills required for a

new position. Assume that there is no depreciation of human capital. We can derive the following theorem. The formal proof is established in the Appendix.

Theorem 2. *Suppose that for any set* $H \in \Theta \backslash \emptyset$, $\hat{C}(H) > 0$. *Then, the reallocation cost is submodular with respect to promotion and horizontal transfer:*

$$\hat{C}\left(H^n(0,0)\right) + \hat{C}\left(H^n(1,1)\right) \leq \hat{C}\left(H^n(0,1)\right) + \hat{C}\left(H^n(1,0)\right),$$

where the inequality is strict if and only if $\left(H_d \cap H^{(i+1)}\right) \cap \left(H_s \cup H^i\right)^c \neq \emptyset$.

Figure 4 explains the intuitive logic behind Theorem 2. When employees stay in the same position, they do not need to acquire any new skills: $H^n(0,0) = \emptyset$. When employees are promoted to directorships in the functional department, they must additionally acquire all skills in the sets A or B: $H^n(1,0) = A \cup B$. When employees are transferred to another functional department as section managers, they need to acquire all skills in the sets B or C. Therefore, $H^n(0,1) = B \cup C$. When employees are transferred to another functional department as directors, they need to acquire all skills in the set A, B or C: $H^n(1,1) = A \cup B \cup C$. Hence:

$$\begin{aligned} & \left[\hat{C}\left(H^n(0,1)\right) + \hat{C}\left(H^n(1,0)\right)\right] - \left[\hat{C}\left(H^n(0,0)\right) + \hat{C}\left(H^n(1,1)\right)\right] \\ = \; & \hat{C}(B \cup C) + \hat{C}(A \cup B) - \hat{C}(A \cup B \cup C) = \hat{C}(B) \geq 0. \end{aligned}$$

Hence, the reallocation cost is in general submodular and equality holds if and only if $B = \emptyset$ where $B = \left(H_d \cap H^{(i+1)}\right) \cap \left(H_s \cup H^i\right)^c$.

Combining the theorems 1 and 2, the following corollary follows.

Corollary 3. *Suppose that for any set* $H \in \Theta \backslash \emptyset$, $\hat{C}(H) > 0$. *Then:*

$$P_{dd}(i+1|d,d,i) \leq P_{ds}(i+1|d,s,i),$$

where the inequality is strict if and only if $\left(H_d \cap H^{(i+1)}\right) \cap \left(H_s \cup H^i\right)^c \neq \emptyset$. *Furthermore, if the marginal benefits from multitask skills are larger for directors than for section managers,* $y(d, i+1, x) - y(d, i, x) > y(s, i+1, x) - y(s, i, x)$, *then there exists* $\beta^* \in (0, 1)$ *such that for all* $\beta(x) \leq \beta^*$*:*

$$P_{ss}(i+1|s, s, i) < P_{dd}(i+1|d, d, i) \leq P_{ds}(i+1|d, s, i),$$

where the inequality is strict if and only if $\left(H_d \cap H^{(i+1)}\right) \cap \left(H_s \cup H^i\right)^c \neq \emptyset$.

Hence, insofar as there is a task-specific skill that cannot be acquired as a section manager in a functional department i, but is required to perform new tasks in a functional department $i+1$ and as a director, it is cost effective to transfer employees when they are promoted. For example, if functional department $i+1$ is bigger than functional department i, dealing with a larger staff might be an important task in functional department $i+1$. This task may also be important for a director, but it may not be important for a section manager in functional department i. Alternatively, if the accounting department requires more paper work than the sales department, the tasks in the accounting department might have similarity to those of directors.

Note that rank-specific skills and department-specific skills cannot explain region B. Region D captures general skills, and regions A and C capture director-specific skills and functional department $i+1$-specific skills, respectively. However, the skills in region B are not purely general, purely rank-specific or purely department specific. The corollary suggests that the existence of these types of skills is necessary in order to explain synchronized decisions of promotion and horizontal transfer. That is, our analysis suggests that the concept of task-specific human capital is essential in order to understand the observed synchronized decisions.

6. From Director to Board Member

In this section, we investigate the transition from director to board member. We raise the question of how promotion from director to board member varies across functional departments. Note that there is no other hierarchical position between directors and board members. Hence, if skills accumulated as directors are useful after promotion, they are only the skills needed for the tasks of board members. This reasoning makes us separate relatively important task-specific skills for board members from other kinds of task-specific skills. We show later that our results are broadly consistent with several theories on entrepreneurial ability.

Let us first describe some simple summary statistics on the speed of promotion to board membership. Table 6 shows the average tenure and age to be promoted to board membership, respectively. It shows that the average tenure is roughly 27 years and the average age is 54 years when one is promoted to board membership in Japan. These numbers are also consistent with the view that the speed of promotion in Japanese firms is slow. Interestingly, the speed of promotion to board membership has become slightly slower over time. The average tenure was 26 years and the average age was 53.6 years in 1998, while the average tenure was 29 years and the average age was 54.3 years in 2005.

In order to obtain information on the relative importance of skills necessary for becoming a board member, we estimate a random logit model. We assume that promotion of the jth individual occurs between $t+1$ and t if and only if $y_{tj} \geq 0$ where y_{tj} is an unobserved latent variable of the jth individual at year t. We also assume that y_{tj} is determined by:

$$y_{tj} = \psi_0 + \sum_{h}^{m} \psi_h I\left(j \in h\right) + \phi' x_{tj} + \gamma_t + \gamma_j + \varepsilon_{tj},$$

where $I(j \in h)$ is a dummy variable of functional departments to which the jth individual belongs, x_{tj} is a vector of observed characteristics of the jth individual at year t, γ_t is a year dummy, γ_j is an unobserved individual-specific factor that is independently identically normally distributed with mean 0 and variance σ_γ^2, and ε_{tj} are independently identically Gumbel distributed. The control variables are the same as those in the previous section, the details of which are explained in the Appendix[6].

Table 7 shows our estimates. The first column shows that the directors who belong to general affairs & press, personnel, accounting and planning departments have a higher probability of being promoted to board membership, while those who belong to research and production departments have a lower probability[7]. Note that the benchmark is the sales department. Hence, the coefficient represents the value relative to the sales department's value.

Although we control for standard individual characteristics, if able employees are more likely to be assigned to these departments, the obtained result may be influenced by this selection mechanism. In order to separate the skill accumulation effect in each functional department from the selection mechanism, we use the headquarters dummy as a proxy for unobserved ability. Our presumption is that a worker's boss can observe his/her unobserved ability and select an able

[6] For this estimation, we extract the data of individuals who are either directors or board members, and eliminate the data of individuals who have served as board members during the entire sample period because our focus is on estimating the determinants of directors' promotion to board membership. Note that after an individual becomes a board member, subsequent data on her/him are not used for this estimation.

[7] "Directors in other departments" also have a higher probability of being promoted to board membership. We consulted the chief editor in Diamond Inc. about what "other departments" meant. He said that if they are not able to find a clear category for the positions in questionnaires, they assign it as "other departments". Because the fraction of "other departments" is less than 0.6 percent in the sample used for this regression analysis, it cannot be representative. Hence, we simply report the results without any interpretation.

worker for transfer to headquarters.

The second column shows that, as expected, the headquarters dummy has a strong positive effect on the promotion probability, which supports our presumption. More importantly, once we control for the headquarters dummy, the coefficients of general affairs & press, personnel, planning and production department dummies lose their significance. Hence, only the accounting department dummy remains positively significant, and only the research department dummy remains negatively significant.

We are worried about the possibility that the headquarters dummy captures a different effect than that of unobserved ability. If many general affairs & press, personnel and planning departments are located at headquarters, it is not surprising that the coefficients of these departments lose their significance after controlling for the headquarters dummy. In order to examine how this possibility influences the result, we only use observations of those working at headquarters. Based on this relatively more homogenous sample, we obtain the same result, which is reported in the third column: only the accounting department dummy is positive and significant.

We also conduct other robustness checks by restricting our study to ages between 40 and 59 years and the period between 1999 and 2002. The fourth column and fifth column report the results of these robustness checks. Although general affairs & press and personnel departments sometimes show significance, their results are not robust. On the other hand, the coefficients of the accounting and research & development department dummies are quite robust: the accounting department dummy is always positive and significant, while the research & development department dummy is always negative and significant.

How can we interpret these results? Note that the role of directors in Japan is

different from that in the U.S. As indicated in Kaplan (1994), Japan's corporate governance system is said to be more consensus-oriented and boards of directors are granted strong powers to manage the corporation. That means Japanese board members are at least partially involved in the decision processes determining the strategy of a company. Hence, it is reasonable to receive assistance from the theory of entrepreneurship in order to interpret these results.

On one hand, the low promotion probability from the research department implies that specialists are less likely to be top managers. This interpretation is consistent with arguments in Lazear (2005). Lazear (2005) provides a theory that agents with a balanced skill set become entrepreneurs and finds that those who have varied work and educational backgrounds are much more likely to start their own business than those who have focused on one role at work or concentrated on one subject at school. As researchers are likely to focus on one subject at work, our evidence confirms his statement.

On the other hand, the relatively high promotion probability from the accounting department is consistent with the view that emphasizes allocative ability as the essence of entrepreneurial ability [e.g., Welch (1970), Schultz (1975) and Takii (2003, 2008)]. Welch (1970) points out that the effect of education on the production process can be decomposed into two components. Higher education enables a worker to increase the amount of output produced from a given quantity of inputs (the worker effect), while it also allows the worker to interpret information about the profitability of resource allocation, which enables the worker to make better use of resources (the allocative effect). Schultz (1975) describes allocative ability as entrepreneurial ability and Takii (2003, 2008) models managers' prediction ability as a source of their allocative ability. Because one of the main tasks of accounting is to allocate funds across several departments, it is reasonable to

assume that this helps to improve managers' ability to attain the best allocation.

This assumption is supported by evidence from case studies. Koike (2002b) conducts several case studies on accounting departments in a Japanese company and two British companies and finds that the most important skill in accounting departments is predicting the source of differences between the planned budget and actual results. Because of unexpected changes in the environment, the actual results are always different from the original plan. Skillful managers can quickly detect the reasons for this. Koike (2002b) insists that this skill can be obtained only from OJT. This evidence supports our interpretation that the relatively high promotion probability from the accounting department to board membership indicates that allocative skill is the essence of entrepreneurial ability.

We also conduct the same estimation on firms with 1000 or more employees. The results are reported in Table 8. Interestingly, not only the accounting department dummy but also the personnel department dummy have a significantly positive effect on the probability of promotion to board membership. This result does not change even when we restrict the sample to headquarters, the age to between 40 and 59 years and the period to between 1999 and 2002. It implies that the personnel department is quite important in large firms.

This is interesting, because a major role for personnel departments is likely to be specific to Japan. Jacoby (2005) points out that, compared with U.S. companies, human resource staffs are centralized and conduct organization-oriented employment decisions in Japan, and that human resource departments rank relatively highly in the corporate hierarchy. Jacoby (2005) also points out that personnel departments in Japan play diverse roles: managing promotion sequences of employees, negotiating with ubiquitous enterprise unions, weighting employee pay toward internal factors rather than market rates, maintaining centralized

programs for employee training, organizing recreation and welfare. Hence, skills accumulated in personnel departments are likely to be broader than allocative ability on its own. That is, evidence suggests that the top managers in Japan's large firms needs not only allocative skills but also the skills to supervise workers in order to maintain Japanese employment practices.

7. Conclusion

This paper provides new evidence on the relationship between horizontal transfer and vertical promotion using the large personnel panel data sets available in Japan, and interprets this evidence from the perspective of task-specific human capital. We find that a firm synchronizes its promotion and horizontal transfer decisions. Using the model of task-specific human capital, we interpret the evidence as the practice of saving the reallocation cost that arise from the duplication of required tasks. We also find that the directors who belong to accounting departments have the highest probability of being promoted to board membership, while those who belong to research departments have the lowest. This suggests that top managers need balanced skill sets, in which their allocative skills are relatively more important.

Note that our findings show that some particular pairs of movement are more frequent than others. Evidence indicates the possibility that the transferability of human capital is likely to be multidimensional. However, this cannot be explained by either rank-specific skill or department-specific skill. This paper demonstrates how the concept of task-specific skill can be used to interpret multidimensional job mobility.

Of course, it might be possible to construct an alternative theory to interpret

our evidence. We have no intention of denying other possibilities, but we note that task-specific human capital can provide a coherent story from the evidence on promotions from section managers to directors and from directors to board membership. Hence, we believe that the concept of task-specific human capital can be useful for obtaining guidance from the data on career paths.

Hopefully, our analysis provides a meaningful benchmark for stimulating alternative theories, that make it possible to distinguish empirically the importance of task-specific human capital from other theories.

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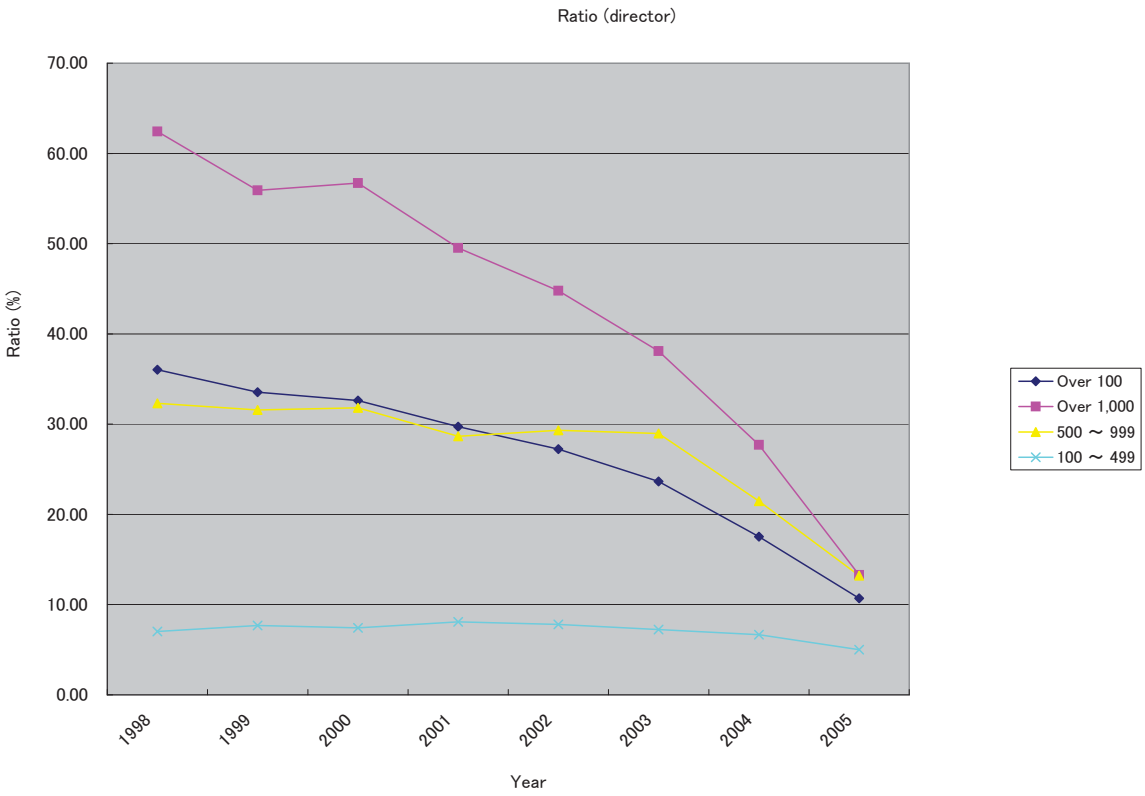
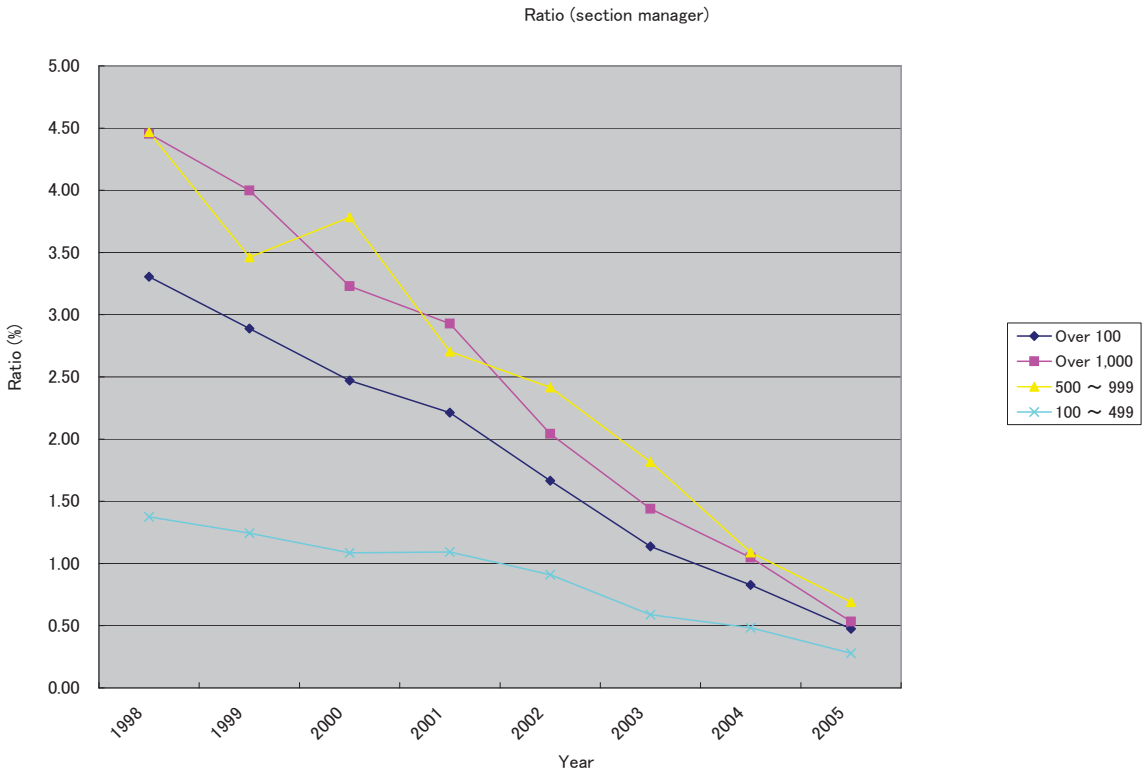
Figure 1 (A): The ratio of the number of male directors by firm size in manufacturing firms in the Diamond survey to the one in the BSWS



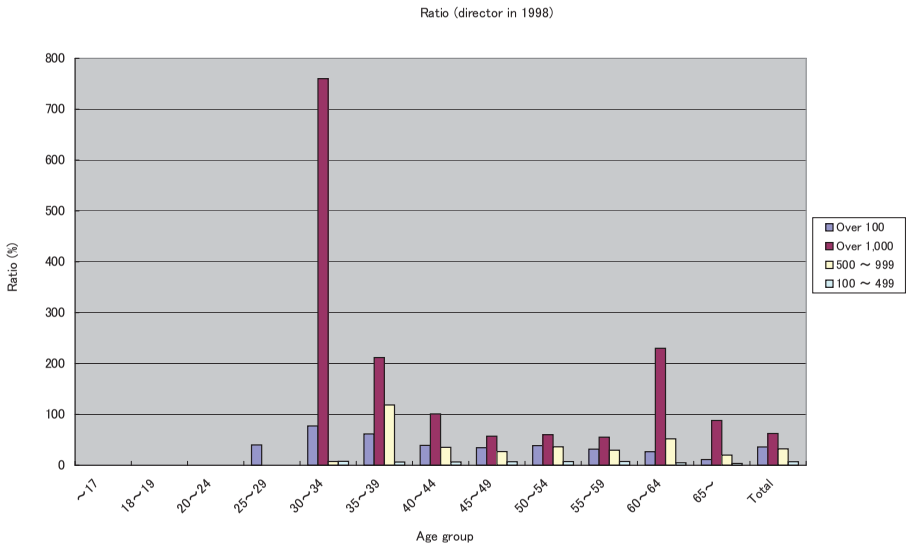
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 1 (B): The ratio of the number of male section managers by firm size in manufacturing firms in the Diamond survey to the one in the BSWS



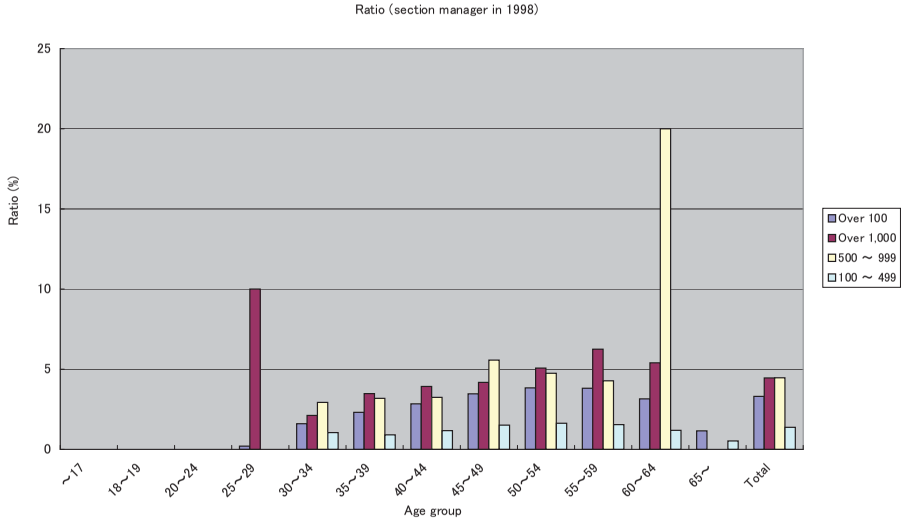
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 2 (A): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



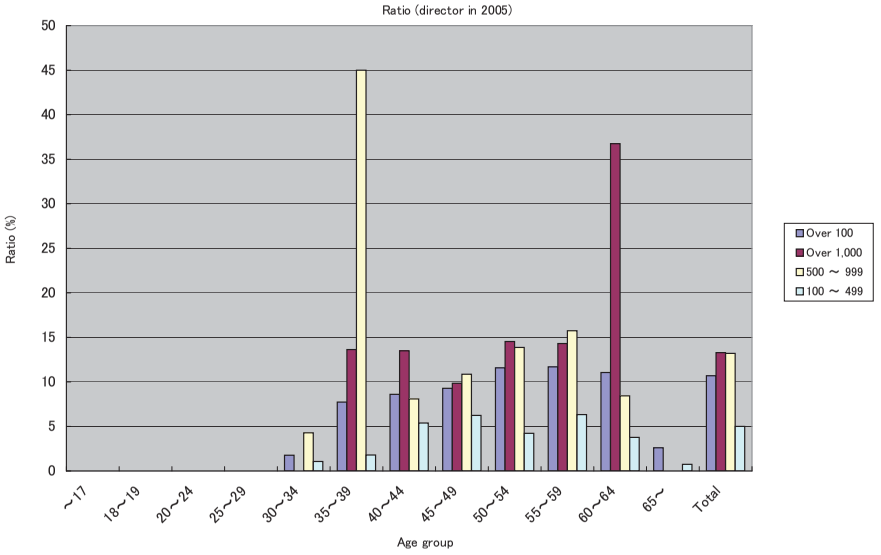
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 2 (B): The ratio of the number of male section manager in the Diamond survey to the one in the BSWS (by age group and by firm size)



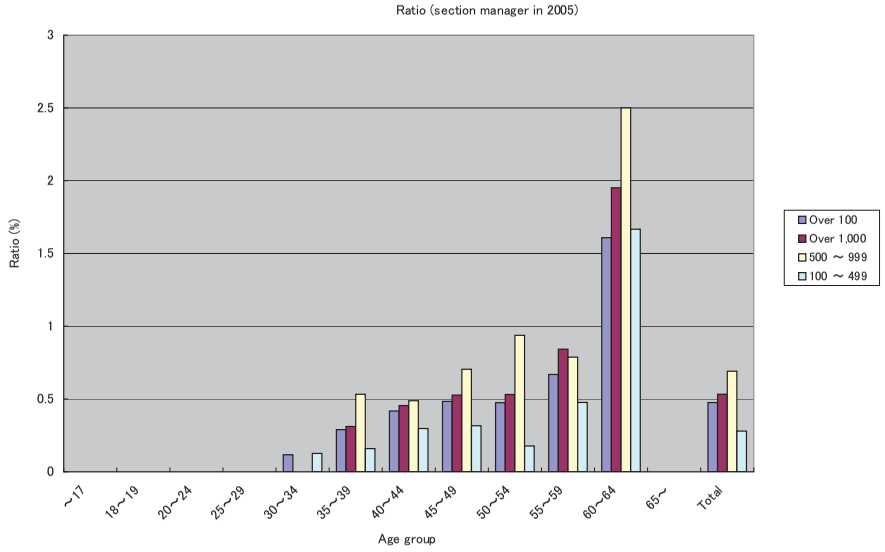
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 2 (C): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



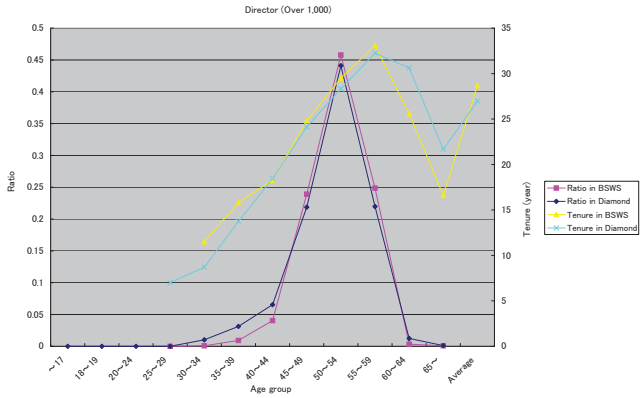
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 2 (D): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



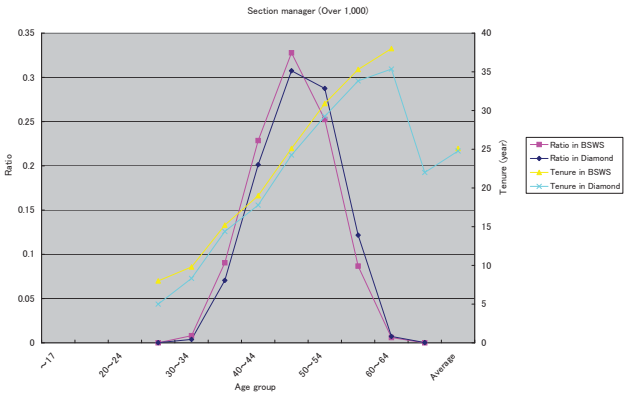
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1998



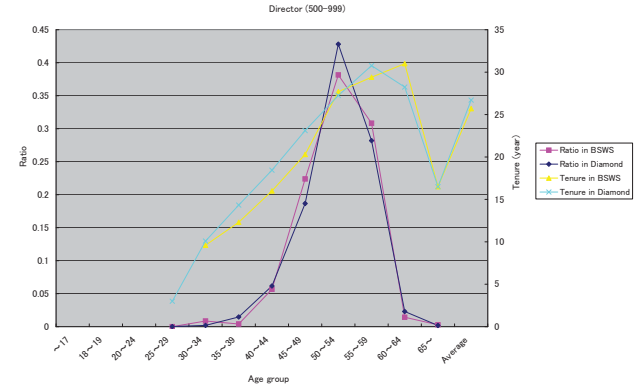
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1998



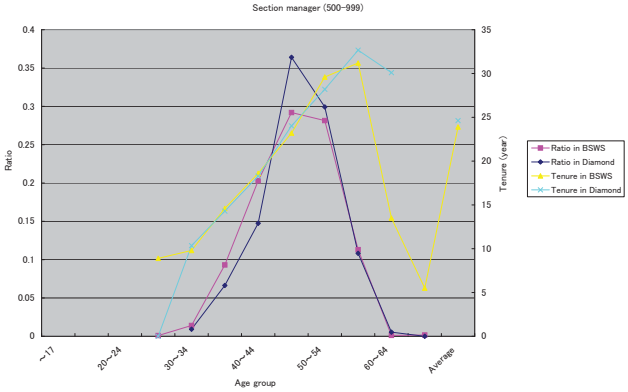
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1998



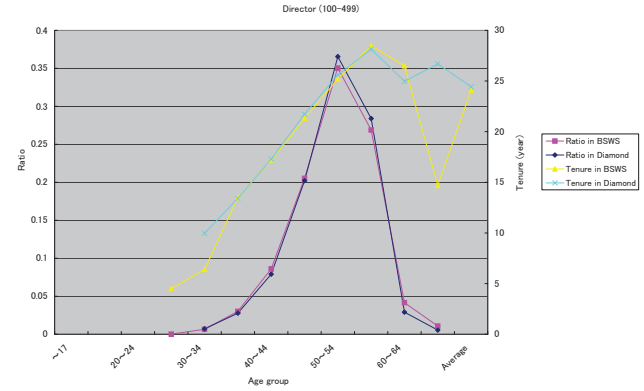
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1998



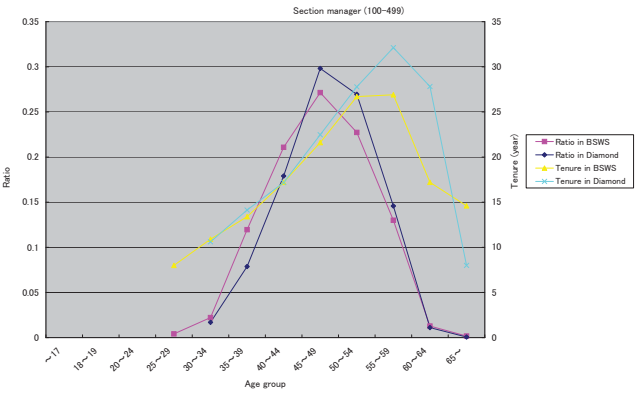
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1998



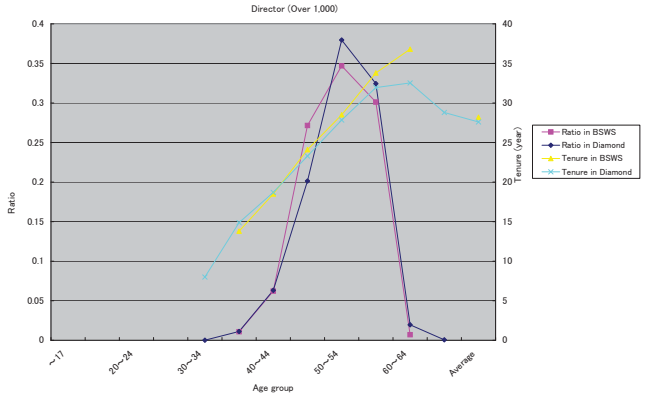
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (A-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1998



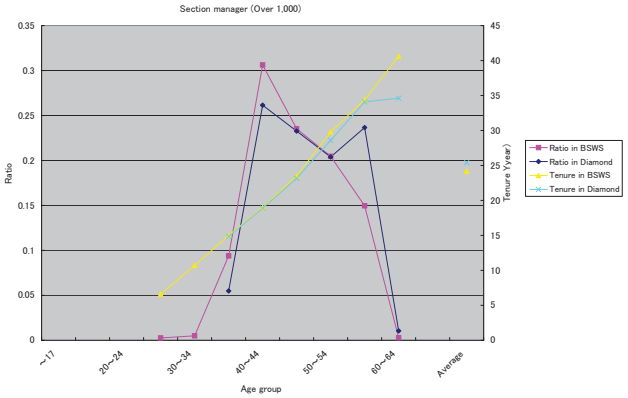
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2005



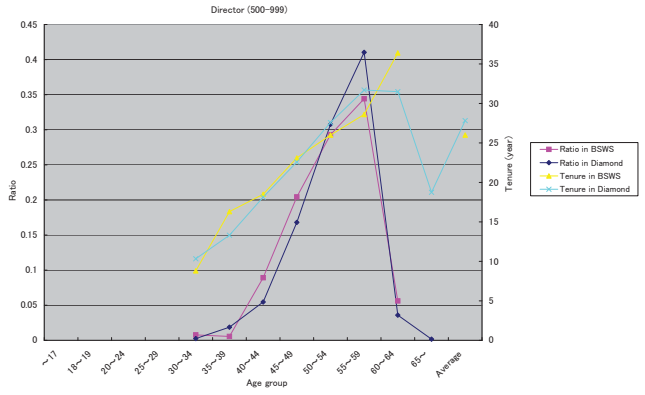
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2005



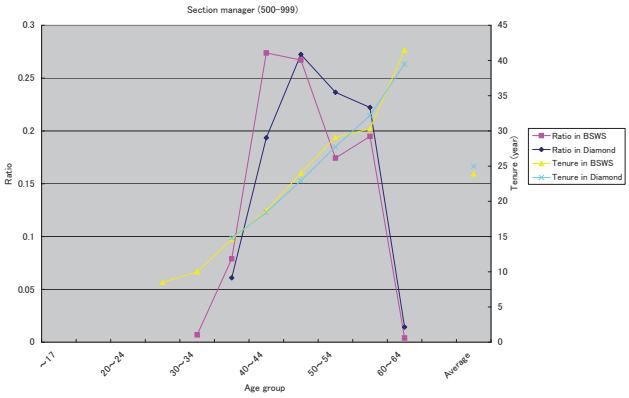
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2005



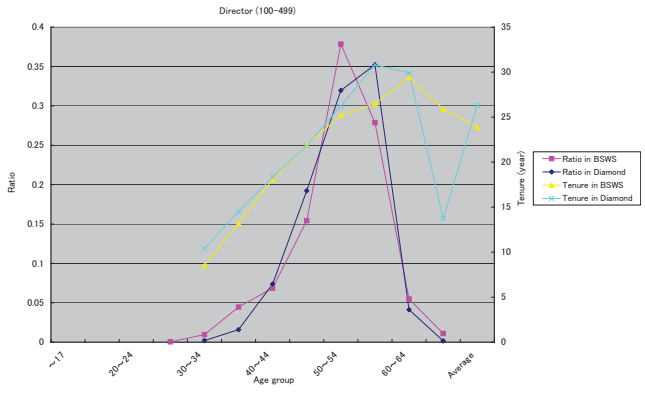
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2005



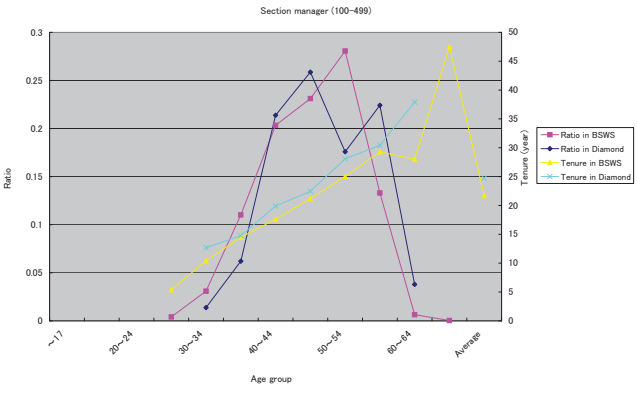
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2005



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 3 (B-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2005



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Figure 4: Skill Requirement when Vertical Promotion or Horizontal Transfer Occurs

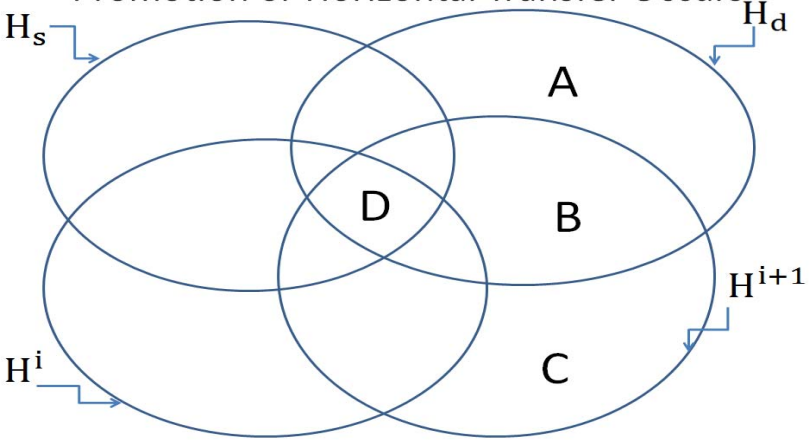


Table 1: Promotion Speed (Section Managers -> Directors)

		all firms			large firms		
		Obs.	Mean year	S.D.	Obs.	Mean year	S.D.
Overall	tenure	5339	23.986	6.912	3447	23.754	6.619
	age	5369	48.280	4.955	3477	47.906	4.884
1998	tenure	832	24.132	6.913	524	24.321	6.305
	age	832	48.105	4.537	524	47.996	4.464
1999	tenure	892	23.936	6.688	619	23.654	6.604
	age	888	47.894	4.616	615	47.506	4.514
2000	tenure	774	24.292	6.989	482	24.394	6.276
	age	812	48.740	5.114	520	48.783	4.783
2001	tenure	964	23.510	7.429	673	22.966	7.320
	age	955	47.936	5.124	670	47.284	5.166
2002	tenure	654	24.086	7.110	438	23.957	6.712
	age	653	48.513	5.208	437	48.037	5.204
2003	tenure	550	24.225	6.578	363	23.931	6.522
	age	551	48.782	5.063	363	48.581	4.889
2004	tenure	379	23.834	6.560	172	23.465	6.131
	age	379	48.596	4.929	172	48.122	4.966
2005	tenure	294	24.010	6.175	176	23.097	5.787
	age	299	47.933	5.141	176	46.881	5.044
High School	tenure	342	32.298	8.134	168	33.780	6.144
	age	344	52.471	4.105	169	52.497	3.492
National University	tenure	1966	23.443	6.280	1431	23.052	6.074
	age	1998	48.189	4.731	1463	47.767	4.731
Public University	tenure	188	24.452	6.659	115	24.426	6.623
	age	189	49.005	4.697	116	48.828	5.019
Private University	tenure	2843	23.331	6.531	1733	23.317	6.310
	age	2838	47.789	4.979	1729	47.512	4.888

We define that large firms hire 1000 employees or more.

Table 2: Transition Matrix (Non-Promoted Sample)

Non-Promoted Section Managers

		present term									
	department	general affairs & press	personnel	accounting	planning	sales	international affairs	research & development (R&D)	production	others	total
previous term	general affairs & press	83.74	2.62	1.31	1.38	3.86	0.28	0.96	5.58	0.28	100.00
	personnel	5.06	88.55	0.36	0.60	2.05	0.12	0.96	2.17	0.12	100.00
	accounting	2.10	0.26	93.43	1.40	1.31	0.00	0.44	0.88	0.18	100.00
	planning	1.86	1.43	0.64	80.23	5.85	0.50	5.71	3.57	0.21	100.00
	sales	0.82	0.19	0.27	1.16	90.14	0.68	2.81	3.93	0.01	100.00
	international affairs	0.66	0.16	0.00	1.48	5.43	87.50	2.47	1.81	0.49	100.00
	research & development (R&D)	0.48	0.46	0.06	2.03	3.53	0.23	88.16	5.00	0.06	100.00
	production	1.29	0.36	0.10	0.89	4.02	0.04	4.16	89.09	0.06	100.00
	others	3.45	3.45	0.00	6.90	3.45	0.00	3.45	0.00	79.31	100.00
	total	5.14	2.95	3.82	5.02	31.20	2.11	21.81	27.81	0.15	100.00

Non-Promoted Directors

		present term									
	department	general affairs & press	personnel	accounting	planning	sales	international affairs	research & development (R&D)	production	others	total
previous term	general affairs & press	79.19	1.81	0.96	2.69	7.02	0.26	2.47	5.45	0.15	100.00
	personnel	4.41	82.44	0.30	2.74	3.92	0.34	2.23	3.39	0.23	100.00
	accounting	3.06	0.34	88.33	3.09	3.02	0.16	0.79	1.08	0.13	100.00
	planning	2.19	0.92	1.01	73.43	8.91	0.76	8.28	4.31	0.19	100.00
	sales	1.28	0.33	0.17	1.96	86.25	0.80	4.39	4.69	0.13	100.00
	international affairs	0.96	0.15	0.34	2.64	12.92	78.27	2.55	2.04	0.13	100.00
	research & development (R&D)	0.80	0.27	0.08	2.73	5.77	0.28	82.92	7.04	0.10	100.00
	production	1.37	0.45	0.10	1.48	6.12	0.24	6.84	83.33	0.08	100.00
	others	4.20	0.70	0.93	5.59	19.58	2.33	8.16	10.26	48.25	100.00
	total	4.71	2.11	2.13	6.28	36.35	2.35	23.56	22.33	0.20	100.00

Table 3: Transition Matrix (Promoted Sample)
Section Managers promoted to be a director

		present term									
	department	general affairs & press	personnel	accounting	planning	sales	international affairs	research & development (R&D)	production	others	total
previous term	general affairs & press	48.51	5.94	3.63	7.26	17.49	0.66	4.29	10.89	1.32	100.00
	personnel	15.47	53.59	0.55	7.73	9.39	0.00	3.87	8.29	1.10	100.00
	accounting	7.17	1.35	67.71	7.17	8.52	0.45	1.35	3.59	2.69	100.00
	planning	5.56	1.67	3.89	47.78	15.83	1.94	13.33	7.78	2.22	100.00
	sales	2.17	0.53	0.66	3.28	74.14	1.55	7.79	8.50	1.37	100.00
	international affairs	1.29	0.65	0.65	4.52	25.81	49.03	9.03	5.81	3.23	100.00
	research & development (R&D)	1.53	0.89	0.06	5.17	9.89	0.64	65.50	14.41	1.91	100.00
	production	2.28	1.07	0.38	3.79	10.62	0.63	15.23	64.85	1.14	100.00
	others	0.00	0.00	8.33	12.50	16.67	0.00	12.50	4.17	45.83	100.00
	total	4.84	2.52	3.04	6.75	32.87	2.12	23.02	23.11	1.73	100.00

Table 4: The breadth of transfers across departments

		S.M. -> S.M.	S.M. -> D.M.	D.M. -> D.M.
Overall	Obs.	487	494	1598
	Mean	0.114	0.333	0.165
	S.D.	0.074	0.162	0.067
1998 to 1999	Obs.	52	57	60
	Mean	0.109	0.328	0.169
	S.D.	0.075	0.160	0.067
1999 to 2000	Obs.	62	69	71
	Mean	0.111	0.325	0.168
	S.D.	0.074	0.177	0.067
2000 to 2001	Obs.	66	79	88
	Mean	0.113	0.335	0.166
	S.D.	0.070	0.159	0.067
2001 to 2002	Obs.	96	80	145
	Mean	0.116	0.326	0.165
	S.D.	0.072	0.158	0.068
2002 to 2003	Obs.	71	76	205
	Mean	0.118	0.330	0.163
	S.D.	0.075	0.150	0.067
2003 to 2004	Obs.	54	73	269
	Mean	0.125	0.332	0.161
	S.D.	0.076	0.171	0.067
2004 to2005	Obs.	86	60	760
	Mean	0.116	0.375	0.158
	S.D.	0.077	0.154	0.069
HQ to HQ	Obs.	209	182	701
	Mean	0.110	0.327	0.167
	S.D.	0.079	0.180	0.072
HQ to Branch Offices	Obs.	11	65	41
	Mean	0.127	0.338	0.181
	S.D.	0.066	0.165	0.062
Branch Offices to HQ	Obs.	7	30	69
	Mean	0.139	0.372	0.182
	S.D.	0.082	0.148	0.063
Branch to Branch Office	Obs.	260	217	787
	Mean	0.114	0.328	0.161
	S.D.	0.070	0.151	0.064

S.M. represensts a section manager while D.M. indicatesa director.

Table 5: Randon Logit Estimations of Functional Transfer (Marginal Effects)

	(1) full samples horizontal transfer	(2) 40-59 years of age horizontal transfer	(3) 1999-2002 horizontal transfer
promotion (1)	1.618 ***	1.616 ***	1.637 ***
(section manager to director)	(0.055)	(0.056)	(0.065)
director (=1)	0.498 ***	0.492 ***	0.496 ***
	(0.038)	(0.038)	(0.043)
HQ	0.405 ***	0.403 ***	0.377 ***
	(0.019)	(0.019)	(0.022)
company type	0.145	0.102	0.073
	(0.112)	(0.113)	(0.159)
large firm	-0.303 ***	-0.318 ***	-0.018
	(0.075)	(0.076)	(0.152)
midium firm	-0.425 ***	-0.444 ***	-0.086
	(0.077)	(0.078)	(0.153)
small firm	-0.665 ***	-0.674 ***	-0.373 *
	(0.078)	(0.079)	(0.154)
national univerity	1.005 ***	1.027 ***	1.152 ***
	(0.174)	(0.186)	(0.198)
public university	0.879 *	0.889 *	1.015 *
	(0.342)	(0.367)	(0.395)
private university	0.573 ***	0.563 **	0.637 ***
	(0.168)	(0.180)	(0.192)
year dummy	Yes	Yes	Yes
home area	Yes	Yes	Yes
manufacturing type	Yes	Yes	Yes
individual characteristics (tenure and other_tenure)	Yes	Yes	Yes
cohort effect	Yes	Yes	Yes
panel-lelvel variance component	-0.007	-0.017	0.134 ***
constant	(0.034)	(0.035)	(0.039)
N	126139	122464	94585
log likelihood	-5.61E+04	−5.47E+04	−4.23E+04

Standard errors in parentheses. * p<0.05, **p<0.01, ***p<0.001. The coefficients are the marginal effects of the independent variables. The reference group for the firm size is the smaller firm where the number of employees is 99 or less. The reference group for education is high school graduates. The cohort effect is defined by the dummies of education times the time trend term. The dependent variable is a dummy indicating one if an employee transferred across departments over the past year. The second column restricts the sample to those aged 40 years or more and 59 years or less. The third column uses the subsample covering the period from 1999 to 2002. Note that the data as of 1999 cover promotion from 1998 to 1999.

Table 6: Promotion Speed (Directors->Boad Members)

		Obs.	Mean year	S.D.
Overall	tenure	8904	26.944	10.169
	age	8928	53.943	3.935
1998	tenure	711	26.065	10.838
	age	710	53.644	3.650
1999	tenure	1042	26.006	11.069
	age	1043	53.896	3.897
2000	tenure	1107	26.211	10.800
	age	1111	53.838	4.038
2001	tenure	1339	26.707	10.362
	age	1346	53.913	3.781
2002	tenure	1174	26.595	10.239
	age	1180	53.704	4.230
2003	tenure	1324	27.158	9.962
	age	1332	53.978	3.819
2004	tenure	1192	27.768	9.469
	age	1187	54.149	4.070
2005	tenure	1015	28.794	8.269
	age	1019	54.345	3.852
High School	tenure	220	29.250	12.527
	age	220	54.027	4.399
National University	tenure	3744	26.224	10.717
	age	3759	54.218	3.474
Public University	tenure	357	27.868	9.455
	age	359	54.312	3.543
Private University	tenure	4583	27.350	9.578
	age	4590	53.686	4.265

Table 7: Marginal Effects on the Promotion Probability: Random Logit Estimations (All Firms)

Dependent variable: promotion (2)	all firms without HQ	all firms with HQ	all firms only with HQ=1	all firms 40-59 years of age with HQ	all firms 1999-2002 years with HQ
general affairs & press	0.164 *	-0.067	-0.072	-0.084	-0.295 **
	(0.068)	(0.072)	(0.112)	(0.075)	(0.105)
personnel	0.413 ***	0.179	0.2358	0.244 *	0.202
	(0.091)	(0.096)	(0.150)	(0.099)	(0.129)
accounting	0.788 ***	0.465 ***	0.7034 ***	0.482 ***	0.436 ***
	(0.082)	(0.087)	(0.132)	(0.091)	(0.118)
planning	0.244 ***	0.011	0.0252	0.018	0.061
	(0.061)	(0.064)	(0.098)	(0.067)	(0.086)
international affairs	0.020	-0.174	-0.29	-0.169	-0.242
	(0.097)	(0.103)	(0.161)	(0.107)	(0.138)
research & development (R&D)	-0.274 ***	-0.287 ***	-0.4188 ***	-0.267 ***	-0.344 ***
	(0.045)	(0.047)	(0.080)	(0.049)	(0.062)
production	-0.095 *	0.020	0.0396	0.020	-0.067
	(0.042)	(0.045)	(0.081)	(0.047)	(0.060)
others	0.897 ***	0.780 **	1.1477 **	0.880 **	0.678
	(0.250)	(0.266)	(0.409)	(0.283)	(0.364)
HQ	No	1.128 ***	No	1.132 ***	1.036 ***
		(0.041)		(0.043)	(0.055)
company type	-0.434 **	-0.394 **	-0.4347	-0.383 **	-0.895 ***
	(0.132)	(0.140)	(0.225)	(0.145)	(0.211)
firm size dummy	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes
manufacturing type	Yes	Yes	Yes	Yes	Yes
individual characteristics	Yes	Yes	Yes	Yes	Yes
cohort effect	Yes	Yes	Yes	Yes	Yes
home area	Yes	Yes	Yes	Yes	Yes
panel-level variance component					
constant	0.061	0.422 **	1.7912 ***	0.522 ***	0.880 ***
	(0.163)	(0.141)	(0.108)	(0.143)	(0.176)
N	118448	118448	52986	115262	87098
log likelihood	-2.28E+04	-2.22E+04	-1.36E+04	-2.12E+04	-1.41E+04

Standard errors in parentheses. * p<0.05, **p<0.01, ***p<0.001. The coefficients are the marginal effects of the independent variables. The reference group for departments is the sales department. There are four types of firm size determined by the number of employees: large, medium, small and minute. The individual characteristics include individual tenure, tenure at other firms and education. The reference group for education is high school graduates. Cohort effect 1 (2 and 3) is defined by the dummy of a national university graduate (public and private university graduate, respectively) times the time trend term. The dependent variable "Promotion (2)" implies promotion from being a director to board membership. The fourth column restricts the sample to those aged 40 years or more and 59 years or less. The fifth column uses the subsample covering the period from 1999 to 2002. Note that the data as of 1999 cover promotion from 1998 to 1999.

Table 8: Marginal Effects on the Promotion Probability: Random Logit Estimations (Only Large Firms)

Dependent variable: promotion (2)	large firms without HQ	large firms with HQ	large firms only with HQ=1	large firms 40-59 years of age with HQ	large firms 1999-2002 years with HQ
general affairs & press	-0.011	-0.207	-0.227	-0.247 *	-0.481 **
	(0.102)	(0.108)	(0.169)	(0.112)	(0.153)
personnel	0.511 ***	0.313 *	0.454 *	0.412 ***	0.376 *
	(0.116)	(0.122)	(0.193)	(0.124)	(0.153)
accounting	0.935 ***	0.632 ***	0.974 ***	0.668 ***	0.642 ***
	(0.119)	(0.125)	(0.190)	(0.129)	(0.157)
planning	0.199 *	-0.028	0.003	-0.027	0.085
	(0.081)	(0.085)	(0.129)	(0.087)	(0.106)
international affairs	-0.030	-0.209	-0.314	-0.204	-0.302
	(0.125)	(0.130)	(0.204)	(0.135)	(0.169)
research & development (R&D)	-0.316 ***	-0.313 ***	-0.405 ***	-0.300 ***	-0.337 ***
	(0.059)	(0.061)	(0.103)	(0.063)	(0.076)
production	-0.184 **	-0.047	-0.064	-0.043	-0.114
	(0.059)	(0.062)	(0.111)	(0.063)	(0.078)
others	0.872 **	0.719 *	1.203 *	0.676	0.627
	(0.337)	(0.357)	(0.558)	(0.377)	(0.491)
HQ	No	1.211 ***	No	1.219 ***	1.118 ***
		(0.055)		(0.058)	(0.071)
company type	-0.918 ***	-0.710 **	-0.765 *	-0.678 **	-1.275 ***
	(0.232)	(0.244)	(0.376)	(0.251)	(0.311)
firm size dummy	No	No	No	No	No
year dummy	Yes	Yes	Yes	Yes	Yes
manufacturing type	Yes	Yes	Yes	Yes	Yes
individual characteristics	Yes	Yes	Yes	Yes	Yes
cohort effect	Yes	Yes	Yes	Yes	Yes
home area	Yes	Yes	Yes	Yes	Yes
panel-level variance component					
constant	0.386 *	0.639 ***	1.932 ***	0.694 ***	0.913 ***
	-0.187	-0.166	0.094	(0.174)	(0.221)
N	79090	79090	33969	77420	61615
log likelihood	-1.34E+04	-1.30E+04	-7.79E+03	-1.25E+04	-8.81E+03

Standard errors in parentheses. * p<0.05, **p<0.01, ***p<0.001. The coefficients are the marginal effects of the independent variables. We use samples of large firms. A large firm is defined as having 1000 employees or more. The reference group for departments is the sales department. There are four types of firm size determined by the number of employees: large, medium, small and minute. The individual characteristics include individual tenure, tenure at other firms and education. The reference group for education is high school graduates. Cohort effect 1 (2 and 3) is defined by the dummy of a national university graduate (public and private university graduate, respectively) times the time trend term. The dependent variable "Promotion (2)" implies promotion from being a director to board membership. The fourth column restricts the sample to those aged 40 years or more and 59 years or less. The fifth column uses the subsample covering the period from 1999 to 2002. Note that the data as of 1999 cover promotion from 1998 to 1999.

8. Appendix

The Proof of Theorem 1: Let $P_{wvzy}(w,v|z,y)$ denote the probability of reallocation from the yth functional department at rank z to the vth functional department at rank w. Define $W^*(r,i,x) = W(r,i,x) - \varepsilon(r,i)$, $r \in \{s,d\}$, and $W^*(b,i,x) = W(b,i,x) - \varepsilon(b)$. Then, we can derive:

$$\begin{aligned}
P_{d(i+1)si}(d,i+1|s,i) &= \frac{\exp[W^*(d,i+1,x') - C(1,1)]}{M}, \\
P_{disi}(d,i|s,i) &= \frac{\exp[W^*(d,i,x') - C(1,0)]}{M}, \\
P_{s(i+1)si}(s,i+1|s,i) &= \frac{\exp[W^*(s,i+1,x') - C(0,1)]}{M}, \\
P_{sisi}(s,i|s,i) &= \frac{\exp[W_s^*(s,i,x') - C(0,0)]}{M},
\end{aligned}$$

where $M = \exp\begin{bmatrix} W_s^*(s,i,x') \\ -C(0,0) \end{bmatrix} + \exp\begin{bmatrix} W^*(s,i+1,x') \\ -C(0,1) \end{bmatrix} + \exp\begin{bmatrix} W^*(d,i,x') \\ -C(1,0) \end{bmatrix} + \exp\begin{bmatrix} W^*(d,i+1,x') \\ -C(1,1) \end{bmatrix}$ and

$$\begin{aligned}
P_{d(i+1)di}(d,i+1|d,i) &= \frac{\exp[W^*(d,i+1,x') - C(0,1)]}{N}, \\
P_{didi}(d,i|d,i) &= \frac{\exp[W^*(d,i,x') - C(0,0)]}{N},
\end{aligned}$$

where $N = \exp\begin{bmatrix} W^*(d,i,x') \\ -C(0,0) \end{bmatrix} + \exp\begin{bmatrix} W^*(d,i+1,x') \\ -C(0,1) \end{bmatrix} + \exp\begin{bmatrix} W^*(b,i,x') \\ -C_b(i) \end{bmatrix}$.
Hence, $P_{sd}(i+1|i,s,d)$, $P_{ss}(i+1|s,s,i)$ and $P_{dd}(i+1|d,d,i)$ can be derived by

applying Bayes' rule:

$$\begin{aligned}
P_{ds}(i+1|d,s,i) &= \frac{1}{1+\exp\{[W^*(d,i,x')-C(1,0)]-[W^*(d,i+1,x')-C(1,1)]\}} \\
P_{ss}(i+1|s,s,i) &= \frac{1}{1+\exp\{[W^*(s,i,x')-C(0,0)]-[W^*(s,i+1,x')-C(0,1)]\}} \\
P_{dd}(i+1|d,d,i) &= \frac{1}{1+\exp\{[W^*(d,i,x')-C(0,0)]-[W^*(d,i+1,x')-C(0,1)]\}}
\end{aligned}$$

Comparing $P_{ds}(i+1|d,s,i)$ and $P_{dd}(i+1|d,d,i)$, we can obtain the following relationship.

$$\begin{aligned}
P_{dd}(i+1|d,d,i) &< P_{ds}(i+1|d,s,i) \\
iff\ C(0,0)+C(1,1) &< C(0,1)+C(1,0).
\end{aligned}$$

This proves the first part of the theorem. Moreover, we can also obtain:

$$\begin{aligned}
P_{ss}(i+1|s,s,i) &< P_{dd}(i+1|d,d,i) \\
iff\ [W^*(d,i+1,x')-W^*(d,i,x')] &> [W^*(s,i+1,x')-W^*(s,i,x')].
\end{aligned}$$

Note that

$$\begin{aligned}
&[W^*(d,i+1,x')-W^*(d,i,x')]-[W^*(s,i+1,x')-W^*(s,i,x')] \\
=\ &[y(d,i+1,x)-y(d,i,x)]-[y(s,i+1,x)-y(s,i,x)]+\beta(x)V^*
\end{aligned}$$

where $V^* = \left\{ \begin{array}{c} \left[\int V(d,i+1,x')\,dF_d(\{\varepsilon(d,j)\},\varepsilon(b),u)-\int V(d,i,x')\,dF_d(\{\varepsilon(d,j)\},\varepsilon(b),u)\right] \\ -\left[\int V(s,i+1,x')\,dF_s(\{\varepsilon(r,j)\},u)-\int V(s,i,x')\,dF_s(\{\varepsilon(r,j)\},u)\right] \end{array} \right\}$

Because V^* is bounded, if $y(d,i+1,x)-y(d,i,x) > y(s,i+1,x)-y(s,i,x)$, then

there exists $\beta^* \in (0,1)$ such that for all $\beta(x) \leq \beta^*$:

$$P_{ss}(i+1|s,s,i) < P_{dd}(i+1|d,d,i).$$

Hence, the desired result is immediate. **Q.E.D.**

The Proof of Theorem 2: Note that $H^n(0,0) = \emptyset$, $H^n(0,1) = \left(H_s \cup H^{(i+1)}\right) \cap (H_s \cup H^i)^c$, $H^n(1,0) = (H_d \cup H^i) \cap (H_s \cup H^i)^c$ and $H^n(1,1) = \left(H_d \cup H^{(i+1)}\right) \cap (H_s \cup H^i)^c$. Hence, it is rewritten that $H^n(0,1) = H^{(i+1)} \cap (H_s \cup H^i)^c$, $H^n(1,0) = H_d \cap (H_s \cup H^i)^c$ and $H^n(1,1) = \left[H_d \cap (H_s \cup H^i)^c\right] \cup \left[H^{(i+1)} \cap (H_s \cup H^i)^c\right]$. Therefore:

$$\begin{aligned}
& \hat{C}(H^n(0,0)) + \hat{C}(H^n(1,1)) \\
= \; & \hat{C}\left[\left[H_d \cap \left(H_s \cup H^i\right)^c\right] \cup \left[H^{(i+1)} \cap \left(H_s \cup H^i\right)^c\right]\right] \\
\leq \; & \hat{C}\left(H^{(i+1)} \cap \left(H_s \cup H^i\right)^c\right) + \hat{C}\left(H_d \cap \left(H_s \cup H^i\right)^c\right) \\
= \; & \hat{C}(H^n(0,1)) + \hat{C}(H^n(1,0))
\end{aligned}$$

Because, for any set $H \in \Theta \backslash \emptyset$, $\hat{C}(H) > 0$, the inequality is strict if:

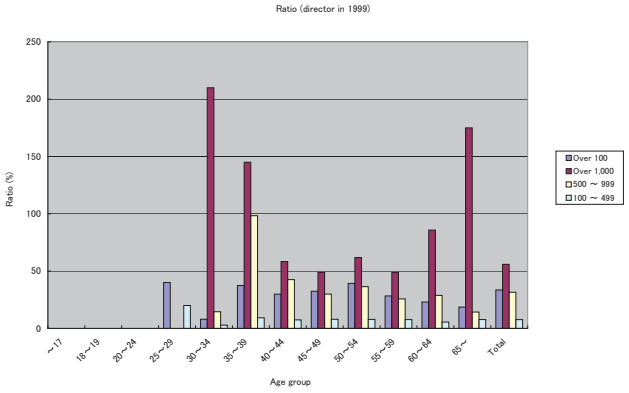
$$\begin{aligned}
\emptyset \; & \neq \; \left[H_d \cap \left(H_s \cup H^i\right)^c\right] \cap \left[H^{(i+1)} \cap \left(H_s \cup H^i\right)^c\right] \\
& = \; H_d \cap H^{(i+1)} \cap \left(H_s \cup H^i\right)^c.
\end{aligned}$$

Q.E.D.

Appendix table: Definition of Variables

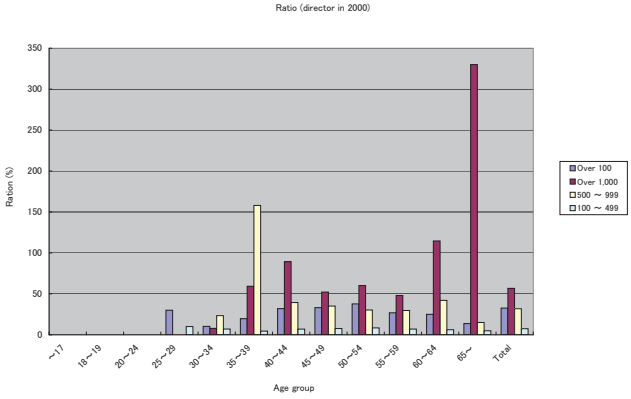
Variables	Definition
promotion (1)	= 1 if an individual is promoted from a director to a board member
promotion (2)	= 1 if an individual is promoted from a section manager to a director
horizontal transfer	= 1 if an individual transfers across departments
Department type	
General affairs & press	= 1 if an individual belongs to the department of general affairs and press when she/he is a director.
Sales	= 1 if an individual belongs to the sales department when she/he is a director.
Personnel	= 1 if an individual belongs to the personnel department when she/he is a director.
Accounting	= 1 if an individual belongs to the accounting department when she/he is a director.
Planning	= 1 if an individual belongs to the planning department when she/he is a director.
International affairs	= 1 if an individual belongs to the international affairs department when she/he is a director.
Research & development	= 1 if an individual belongs to the research and development department when she/he is a director.
Production	= 1 if an individual belongs to the production department when she/he is a director.
Others	= 1 if an individual belongs to other departments when she/he is a director.
Company type	= 1 if a company is listed on a regional stock market or the JASDAQ.
HQ	= 1 if an individual works in the headquarters.
Tenure	Tenure is defined by the difference between the current year and the year an individual joined the company.
Other_tenure	Other_tenure is defined by the difference between the year an individual joined the current company and her/his graduation year.
National univ.	= 1 if an individual graduated from a national university.
Public univ.	= 1 if an individual graduated from a prefectural or municipal university.
Private univ.	= 1 if an individual graduated from a private university.
Cohort 1	national univ. dummy × a time trend
Cohort 2	public univ. dummy × a time trend
Cohort 3	private univ. dummy × a time trend
Manufacturing types	Middle-classified manufacturing sector where an individual belongs to a firm in the textile, pulp/paper, chemistry, drug medicine, petroleum & coal, rubber, glassware, steel, nonferrous metal, metal, machinery, electric, accurate instrument, transportation, or other industries.
Home area	The block area where an individual is from (Hokkaido/Tohoku, Kita-Kanto/Koushinetsu, Minami-Kanto, Hokuriku, Tokai, Kinki, Chugoku, Shikoku, Kyushu/Okinawa)
year dummy	1999, 2000, 2001, 2002, 2003, 2004, 2005 Note that the data as of 1999 cover promotion from 1998 to 1999

Appendix (A-1): The ratio of the number of male directors the Diamond survey to the one in the BSWS (by age group and by firm size)



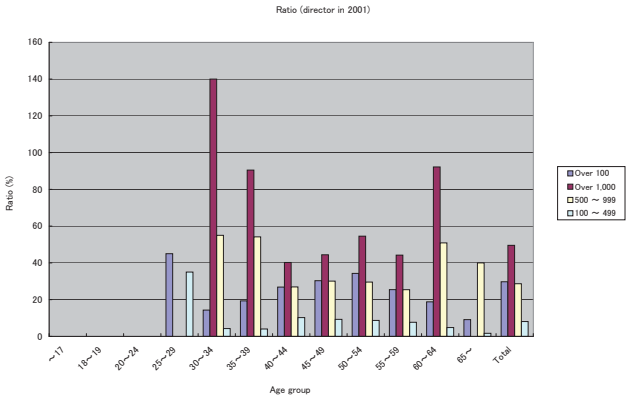
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (A-2): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



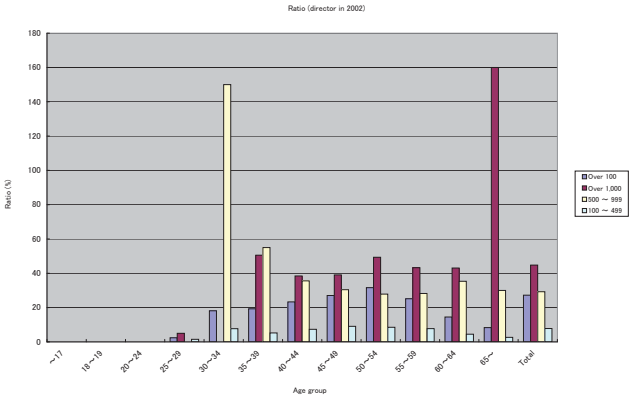
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (A-3): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



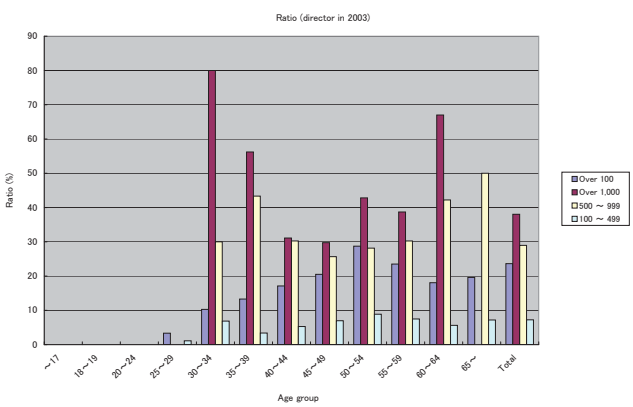
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (A-4): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



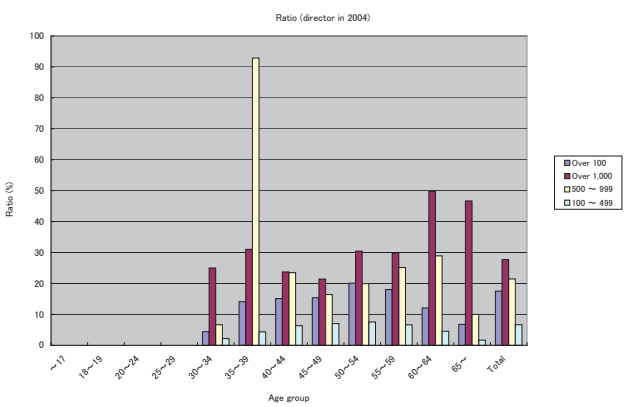
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (A-5): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



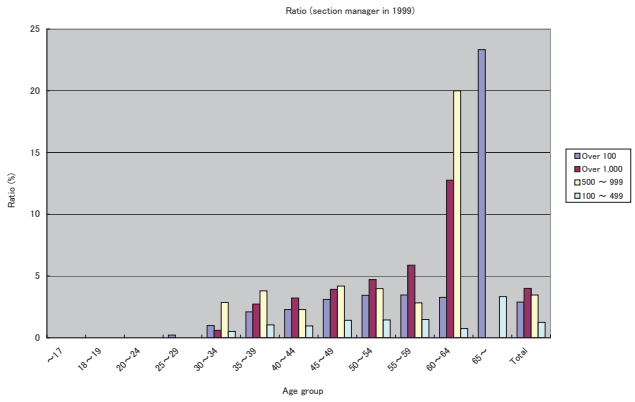
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (A-6): The ratio of the number of male directors in the Diamond survey to the one in the BSWS (by age group and by firm size)



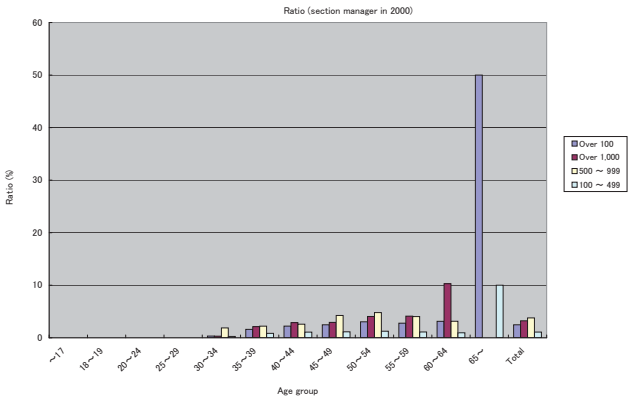
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-1): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



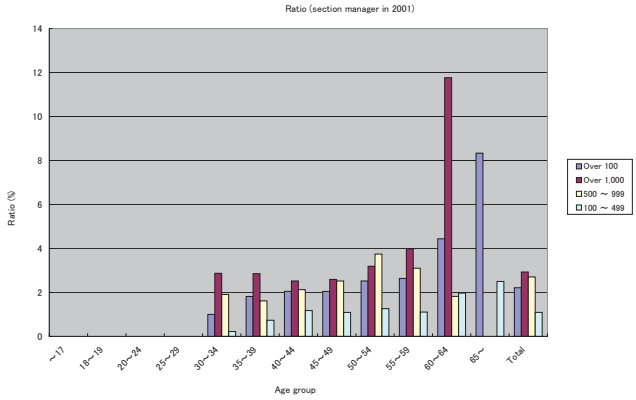
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-2): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



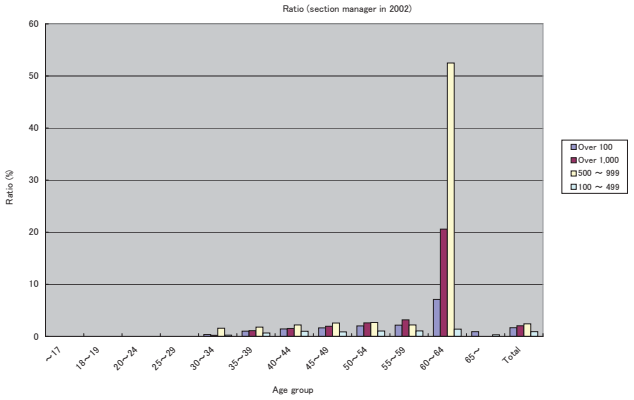
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-3): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



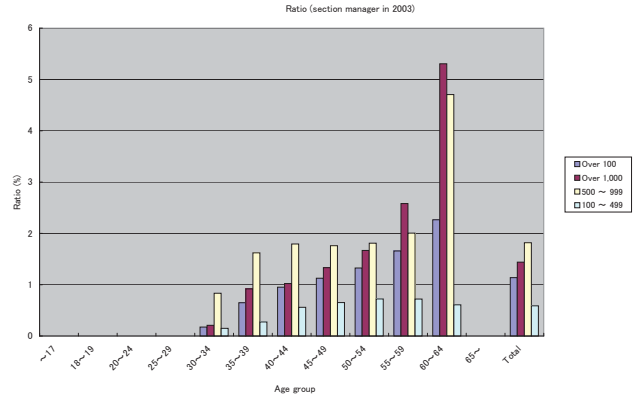
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-4): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



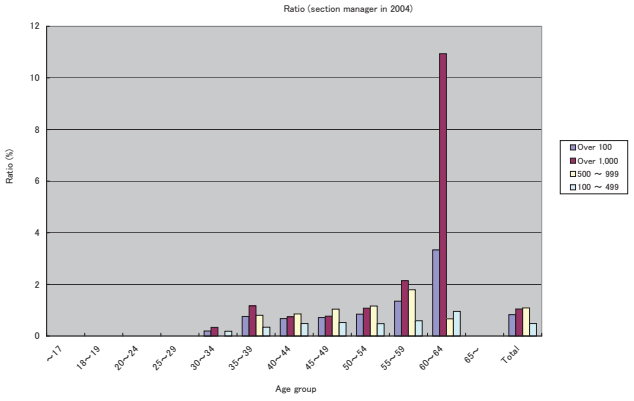
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-5): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



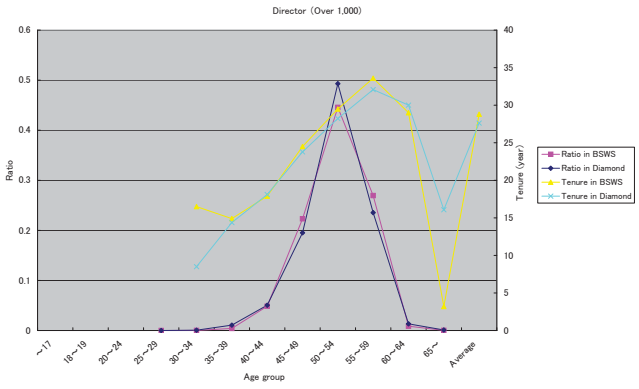
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (B-6): The ratio of the number of male section managers in the Diamond survey to the one in the BSWS (by age group and by firm size)



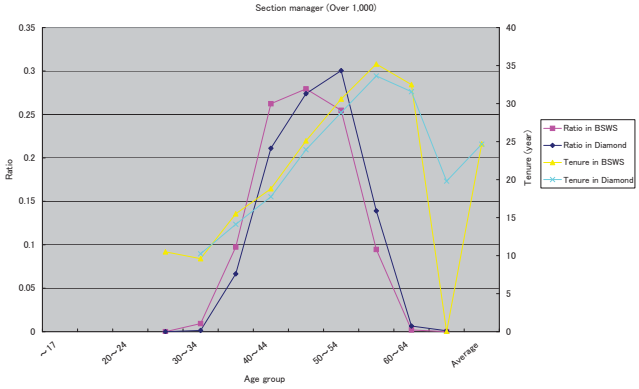
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1999



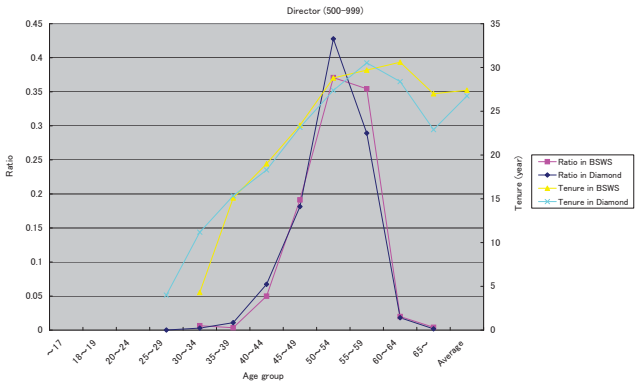
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1999



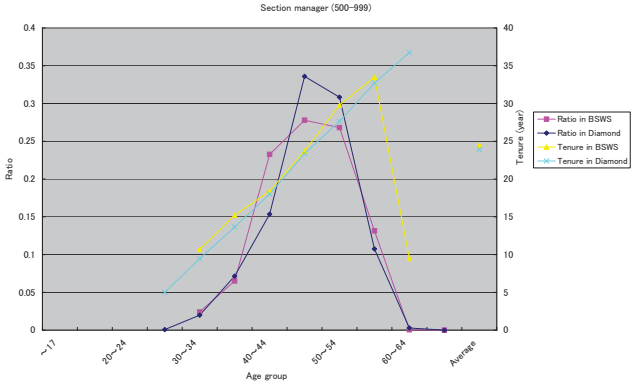
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1999



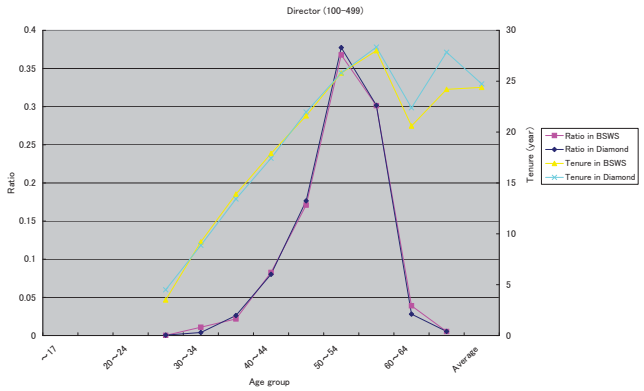
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1999



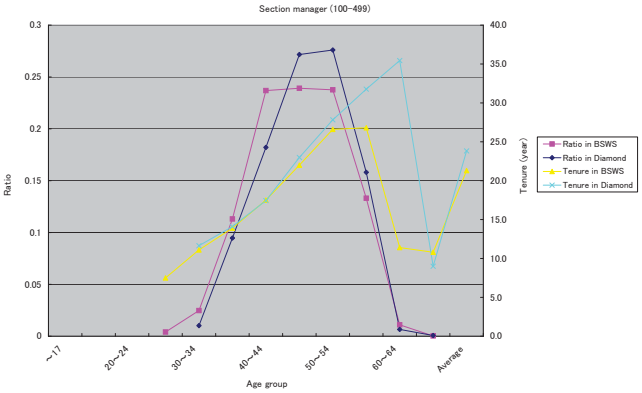
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 1999



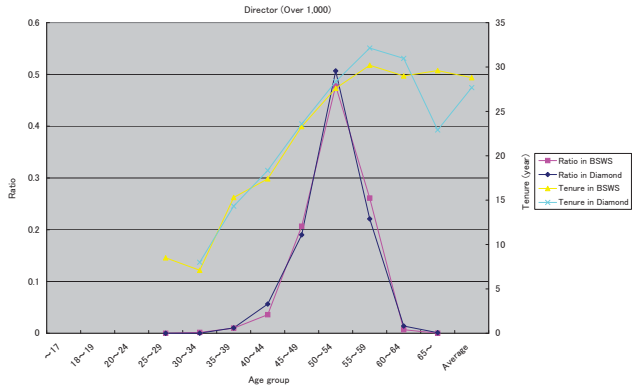
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (C-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 1999



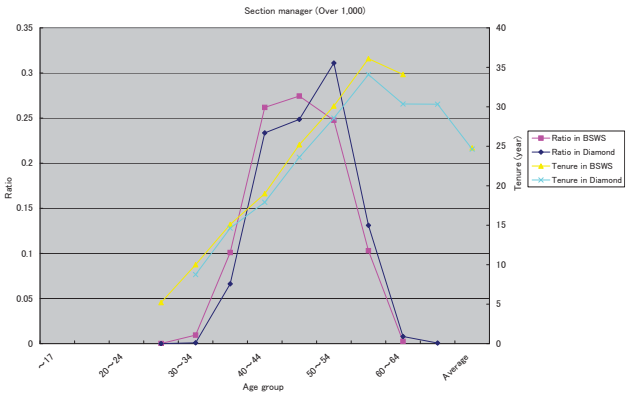
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2000



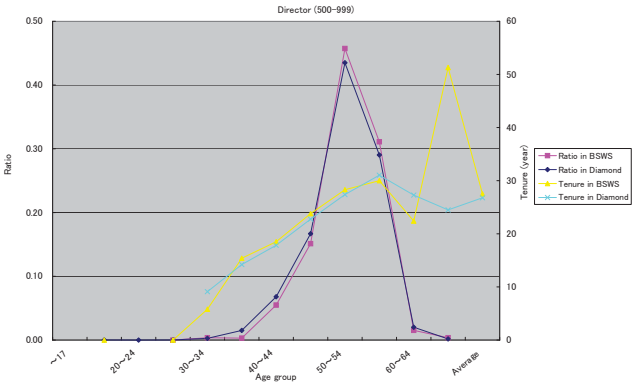
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2000



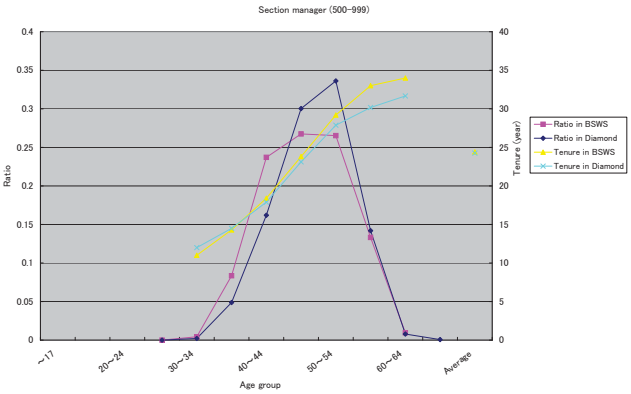
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2000



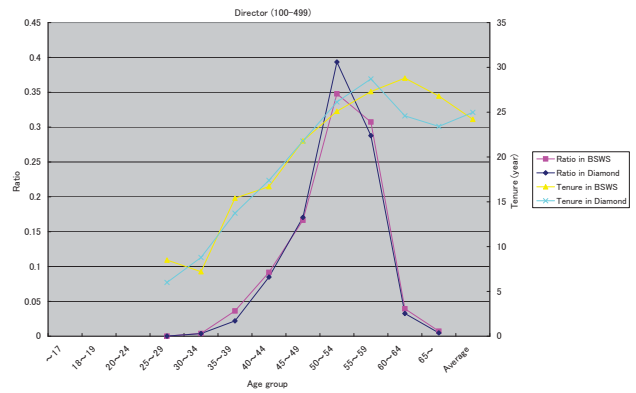
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2000



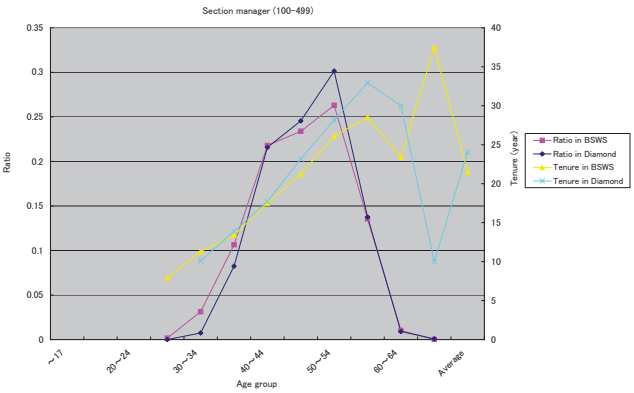
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2000



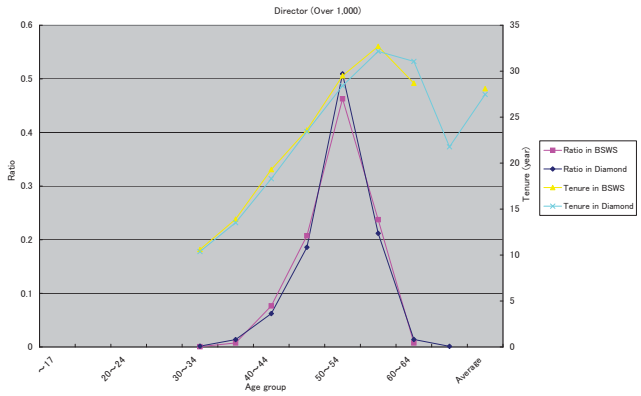
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (D-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2000



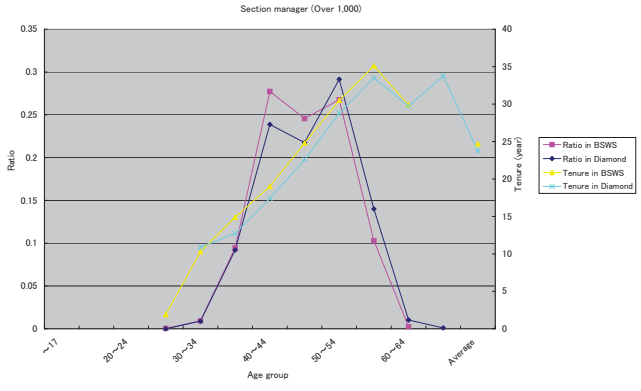
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2001



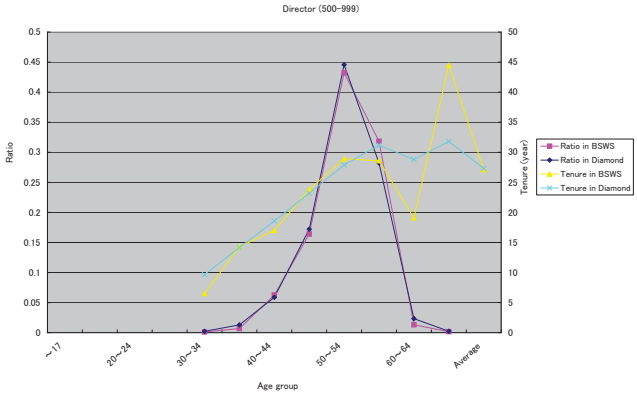
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2001



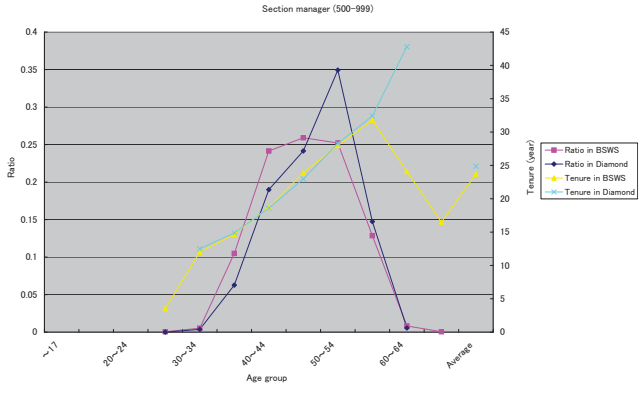
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2001



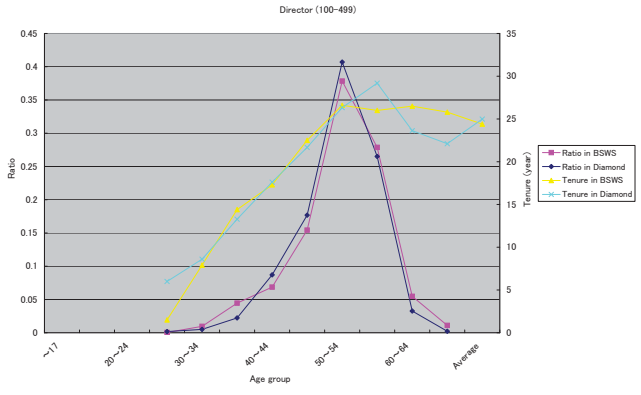
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2001



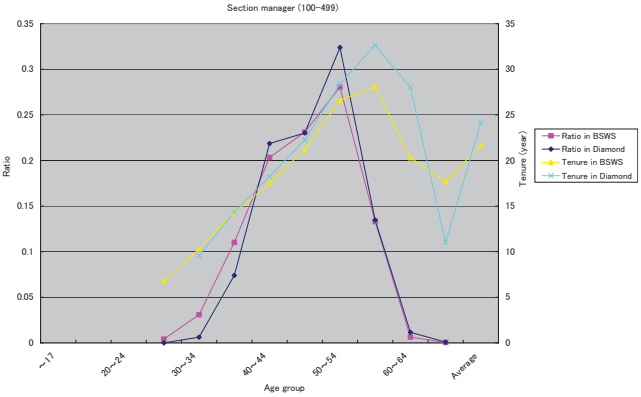
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2001



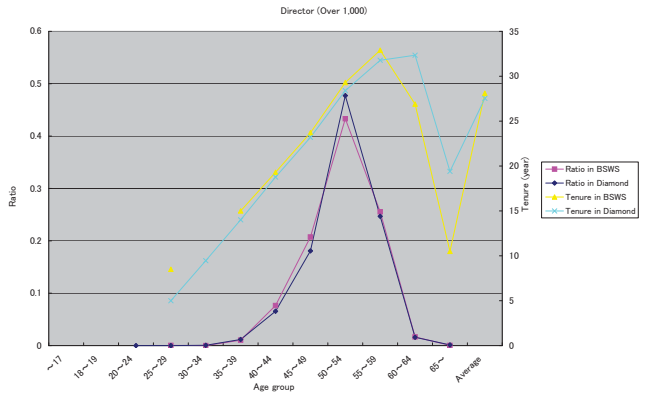
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (E-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2001



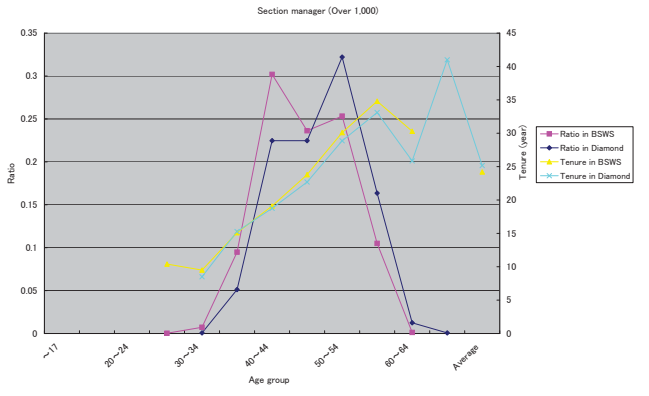
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (F-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2002



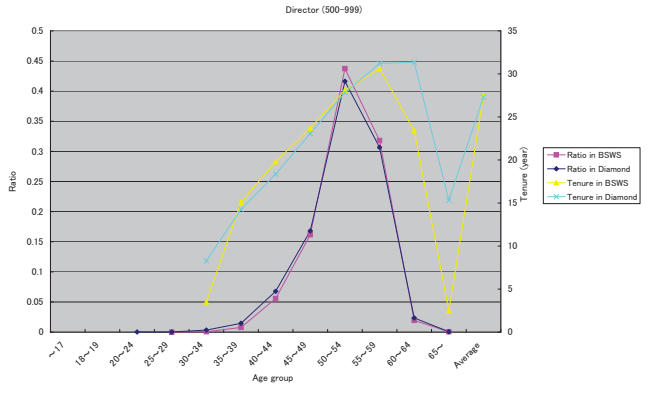
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (F-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2002



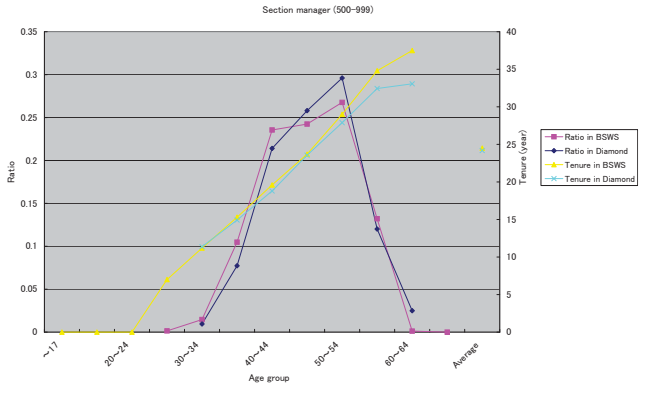
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (F-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2002



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (F-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2002



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

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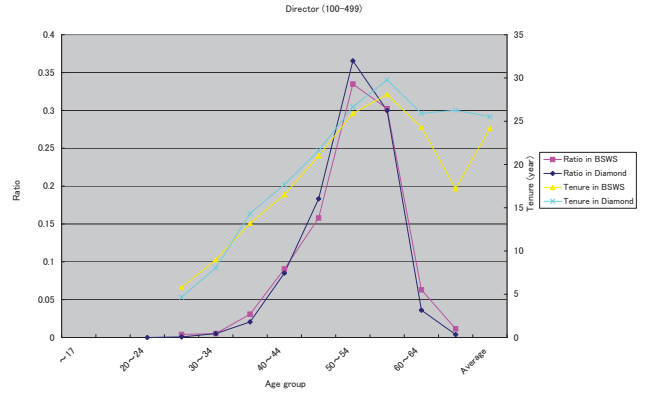
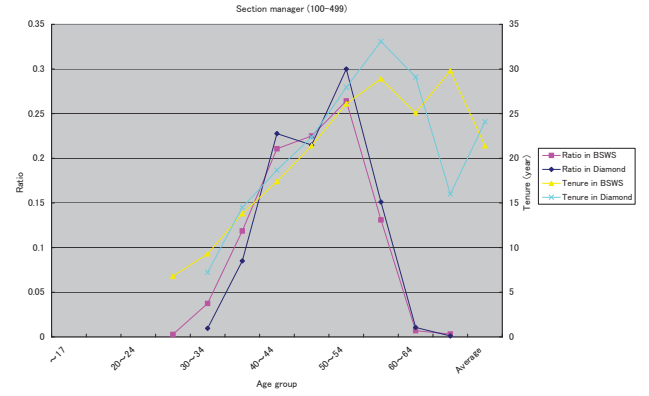


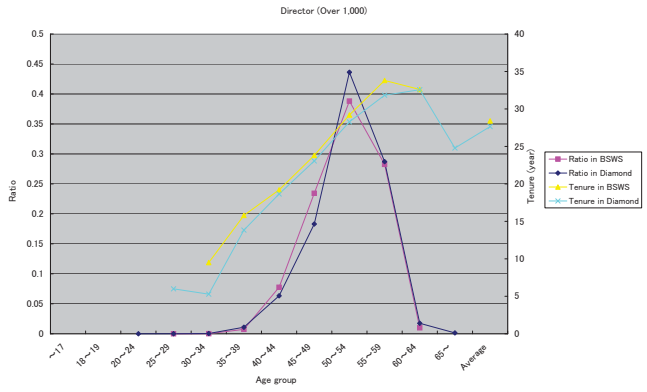
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (F-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2002



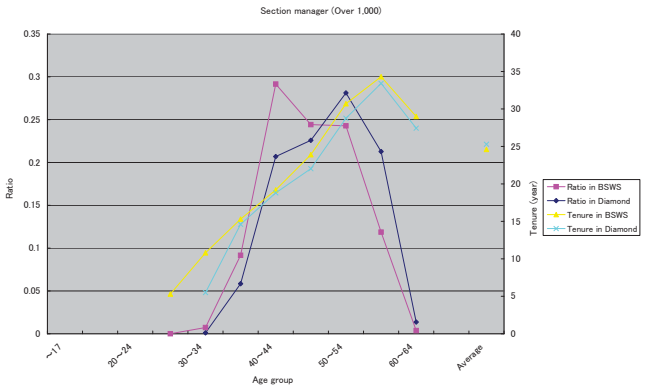
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (G-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2003



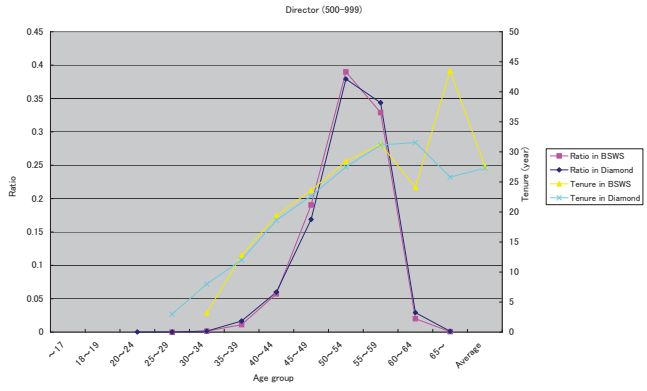
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (G-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2003



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (G-3): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2003



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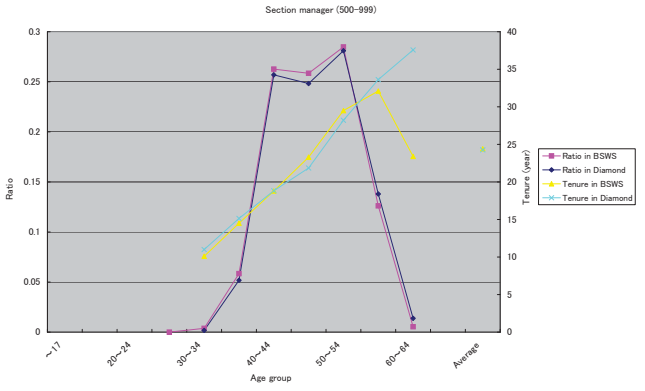
Appendix (G-4): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2003



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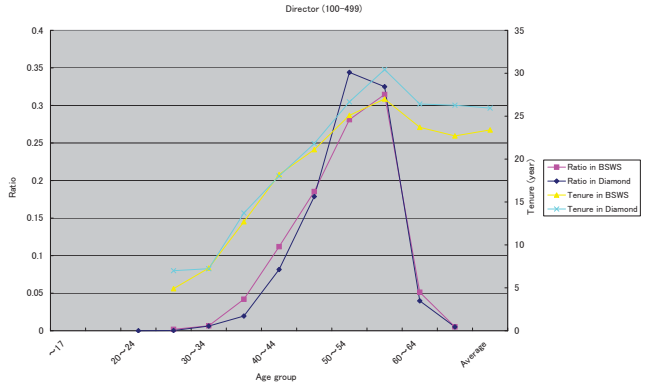
Appendix (G-5): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2003



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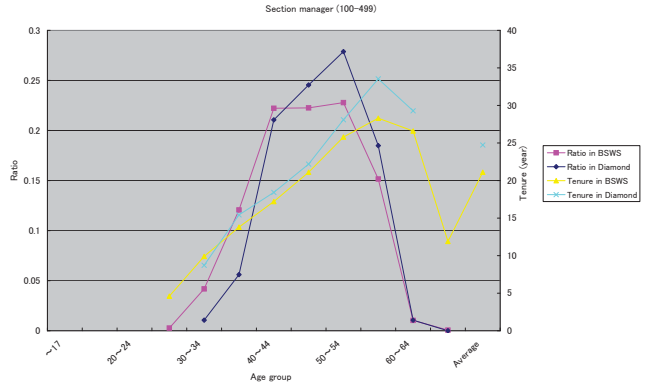
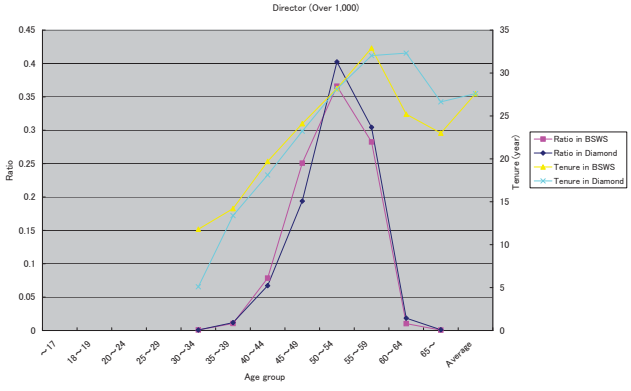
Appendix (G-6): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2003



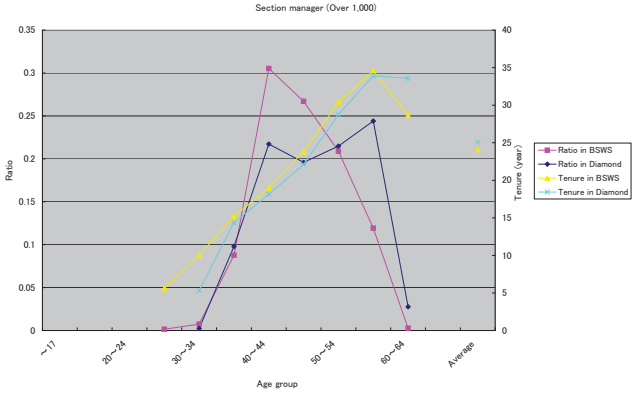
Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (H-1): The ratio of the number of male directors by age group to the total ones, and the tenure of male directors by age group in the Diamond survey and the BSWS in 2004



Note: The `BSWS' means the `Basic Survey on Wage Structure' conducted by the `Ministry of Health, Labour and Welfare;' The `Diamond' survey means the `Diamond Database Service' conducted by Diamond Inc.

Appendix (H-2): The ratio of the number of male section managers by age group to the total ones, and the tenure of male section managers by age group in the Diamond survey and the BSWS in 2004



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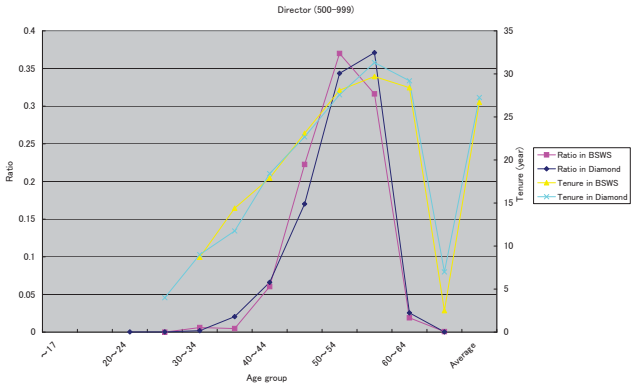

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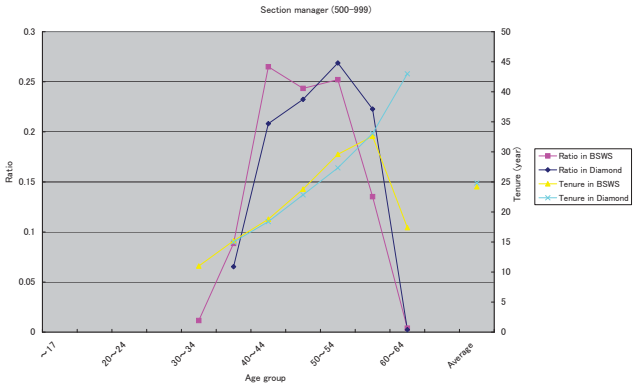

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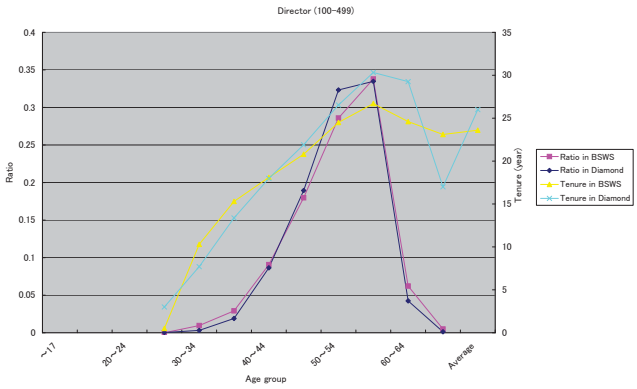

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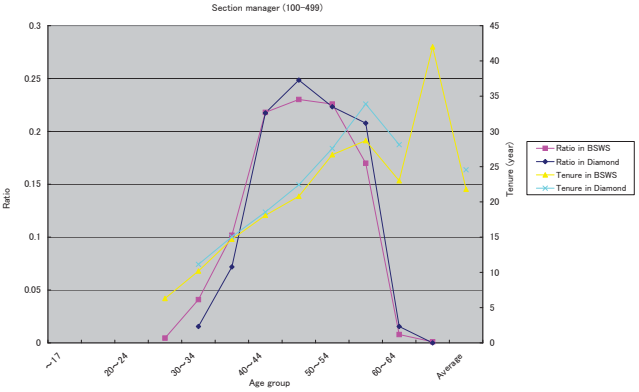

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