RANKING HIERARCHY AND RANK ORDER TOURNAMENT*

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Abstract

This paper examines the relationship between pay structure and the pattern of promotion within Japanese companies, with particular emphasis on the pay gap between employees in adjacent ranks in the hierarchy; i.e., between *Bucho* (division manager) and *Kacho* (subdivision manager). One of the most important contributions of this paper, which examined data from a national survey, is that we use tournament theory to analyse pay gaps between employees in Japan, showing that there is a negative relationship between the pay gap and the possibility for promotion. In addition, the pay gap becomes larger as an employee goes up the hierarchy.

Key words: Tournament; Wage; Japan
JEL classification: J3; J33

I. *Introduction*

This paper examines the relationship between pay structure and promotion patterns within Japanese companies, with particular emphasis on the pay gaps between employees in adjacent ranks of the hierarchy, i.e., between the division manager and the subdivision manager, called *Bucho* and *Kacho* respectively.

It is often argued that there are some distinctive features in the employment structure of Japanese firms, which is frequently described as 'ranking hierarchy' [Aoki (1988)]. In large Japanese firms, white-collar workers tend to be assessed by their relative performances, rather than by their absolute performances [Tomita (1992); Hanada (1993); Koike (1994)], and their job descriptions are not clear [Kagono et al. (1983); Aoki (1988, 1990); Ito (1994)]. Vacancies in managerial positions are filled by internal promotions [Tomita (1992); Hanada (1993)]. Some studies suggest that tournament-type pay structures may work effectively [Aoki (1988, 1990); Ito (1994)]. Therefore, we tested whether tournament type pay is used in Japanese firms.

To analyse this hypothesis, we used data from the Basic Survey of Wages. These data are for the period 1984-1998. In general, our results are consistent with rank order tournament theory, showing that the pay gap becomes larger as an employee goes up the hierarchy. In addition, there is a negative relationship between pay gap and the possibility for promotion, which is calculated as the ratio of the number of employees who are in adjacent layers. These results suggest that employees are motivated to work hard to be promoted to higher rank within the firm.

The main contributions of this paper are summarized as follows. Firstly, this research is one of the first studies that applies tournament theory to analyse pay gaps between employees in Japan. We analysed the pay gaps between *Bucho* (division manager), *Kacho* (subdivision manager), *Kakaricho* (section chief), foreman, and other employees.

Secondly, this paper analyses the relationship between pay gap and promotion by using data from the Basic Survey of Wages, which is the comprehensive national survey in Japan.

II.   Can Rank Order Tournaments Work Effectively in Large Japanese Companies?

It is sometimes argued that salaries for managers are larger than is warranted by their productivity or their contribution to the company. One reason why companies 'overpay' their top managers is that the managers' salaries motivate not only managers, but also other employees. If the director's compensation is high enough, for example, then many employees may work hard to be promoted to director, according to rank order tournament theory [Lazear and Rosen (1981); Lazear (1991, 1995)]. Rank order tournament theory, which analyses the incentive structure within firms, implies that the payments for managers include some premiums for gaining promotion to the higher layers of the corporate hierarchy. Employees are likely to work hard if the bonuses for gaining promotion are large.[1]

According to Lazear (1995), one of the most important advantages of rank order tournaments is that companies can reduce their spending on monitoring the performance of its employees. In other words, this system works effectively if it is not easy for companies to assess the individual performance of workers.[2] As many scholars have suggested, in large companies in Japan, job descriptions are typically less clear-cut than they are in western companies [Kagono et al. (1983); Aoki (1988, 1990); Ito (1994)]. In other words, it is difficult to determine each worker's contribution because the responsibility of each worker is not well defined. Rank order tournaments may be effective in this situation, because exact performance figures are not required to assess each worker.

Rank order tournaments are supposed to be less effective if cooperation is very important, because of relative performance evaluation [Lazear (1995)]. Employees may engage in uncooperative behaviour to outdo their rivals. Considering that a cooperative attitude is one of the most highly valued skills in Japan, it would appear that rank order tournament type pay/

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[1] There are some studies that test the tournament theory empirically in the USA. The study by Main et al. (1993) shows that the pay gap between the directors of adjacent layers increase as the layers approach the CEO level. Demsetz (1995) also shows that there is an increasing pay gap between directors on ascending the hierarchy within the company. However, there are relatively few studies that apply rank order tournament theory to Japanese firms.

[2] Otherwise, piece-rate pay may be a better way to motivate employees.

promotion schemes cannot work, since relative performance evaluation is considered to discourage cooperation among workers. However, many Japanese companies avoid this problem by emphasizing cooperative behaviour in assessing its employees. In typical Japanese companies, factors such as a cooperative attitude, willingness to help others, and ability to communicate with other team members, are important criteria in assessment. In this way, employees are supposed to 'compete to cooperate', and cooperative behaviour can be encouraged even under relative performance evaluation.[3]

Tomita (1992) examined individual level micro-data in a bank and found that promotion is positively correlated with tenure and assessment. Newly recruited employees are allocated to the bottom rank of the hierarchy and compete with each other for faster promotion [Hanada (1993)]. These studies show that vacancies in managerial positions are filled by internal promotion. According to tournament theory, this may encourage employees to work hard, because of the possibility of one of them being promoted as soon as there is a vacancy in a higher position.

We summarize our discussion as follows. Rank order tournament type pay systems may work effectively in motivating employees to work hard to be promoted in Japanese companies. This leads us to another question: do Japanese firms have tournament type pay structure? We address this question by examining the relationship between pay gap and the probability of promotion of employees.

III. *Rank Order Tournaments and Pay Gaps*

One of the most important implications of the rank order tournament theory is that the incentive of employees may depend on the pay gap between employees, rather than the level of their pay. The tournament theory predicts that the pay gap between employees is large when the probability of promotion is small. If employees think they have little chance to be promoted, they may be less motivated to work. However, if the pay gap is large enough, employees may have incentives to work hard even though the possibility of promotion is low.

Similarly, as the competition to be promoted is stronger, employees in higher ranks may feel that they have smaller chance of being promoted. If this were the case, the pay increase for being promoted would need to be larger for employees in higher layer of the hierarchy.

In other words, tournament theory suggests that the pay gap is larger when employees see themselves as having less chance of being promoted. If the pay gap is large enough, and if employees think they have at least a fair chance of being promoted , they have incentive to work hard. If they think that their chances are slim, the pay gap needs to be large enough to motivate them. Thus, we tested the following hypotheses.

Hypothesis 1: The pay gap between employees in adjacent layers of the hierarchy of companies is larger as an employee ascends the corporate ladder.

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[3] There is a problem of collusion between employees in rank order tournament schemes. Employees may collude with each other to not work hard. However, in the typical Japanese firm, this problem is avoided by frequent job rotation.

TABLE 1.   SALARY BY RANK IN 1998 (yen)

	Bucho	Kacho	Kakaricho	Foreman	Others
Monthly wage (including overtime)	646,719	522,191	436,637	422,553	344,729
Monthly wage (excluding overtime)	642,476	516,326	396,787	355,613	305,770
Bonus	3,336,691	2,615,024	1,892,504	1,641,186	1,250,856
Total salary	11,097,310	8,881,311	7,132,150	6,711,818	5,387,606

Source: Basic Survey of Wages

Note: These figures show average salary for male employees in each rank, in firms with 100 or more employees. Total salary is calculated by adding 12 times of monthly wage (including overtime pay) and bonus. *Bucho, Kacho, Kakaricho* corresponds to division manager, subdivision manager, and section chief.

Hypothesis 2: The pay gap between employees in adjacent ranks is negatively correlated with the possibility that an employee in lower rank can be promoted to upper level.

IV.   Data

In this research, we used data from the Basic Survey of Wages. The period covered by our data is 1984-1998. We obtained the amount of monthly wages (including and excluding overtime pay) and bonuses. We calculated total salary by adding bonus and 12 times the monthly wage (including overtime).

We obtained the average of these salaries for each layer of the firm: *Bucho* (division manager), *Kacho* (subdivision manager), *Kakaricho* (section chief), foreman, and others (non-managerial positions). Table 1 shows the average salaries for employees in each rank. Our data contains salaries of employees in firms with 100 or more employees.
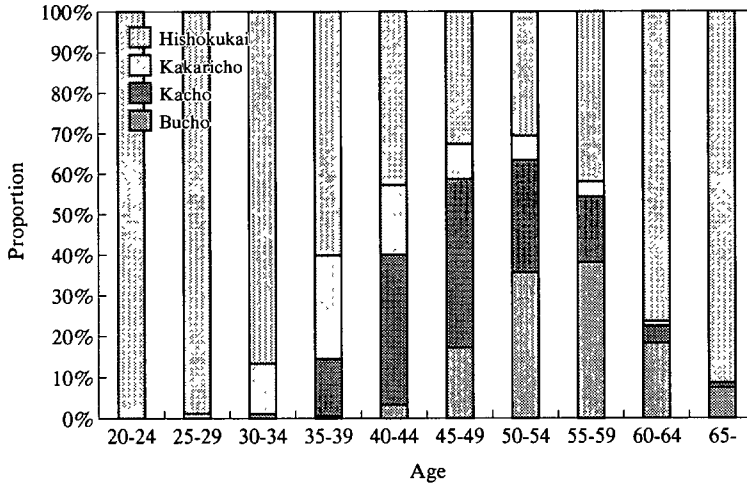
V.   Promotion of Managers

In this section, we examine the pattern of promotion from the above data, analysing how this pattern has been changed from 1984 to 1998. One of our focuses is the change in the speed of promotion, because many authors suggest that 'slow promotion' is one of the main characteristics of Japanese firms [Koike (1991); Hanada (1993)].

Fig.s 1-8 show the proportions of employees in each rank, by age band. Fig.s 1-5 show those employees who are university graduates and Fig.s 6-8 are for high school graduates.

Fig.s 1-3 show the proportion of employees in each rank for 1998, 1990, and 1984, respectively. Only university graduates are included in these figures. These figures show that the proportions of employees in each rank were relatively unchanged throughout this period. Typically, employees became Kakaricho around 30-35 years old, and became Kacho at 35-40 years. Then, some are promoted to Bucho when they were about 40-49 years of age. However, the proportions of those in non-managerial positions increased throughout this period.

Fig. 4 and 5 show similar trends for smaller companies. Fig. 4 shows this proportion for companies with 500-999 employees and Figure 5 is for those with 100-499 employees. Figure

FIG. 1 PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
MALE GRADUATES IN FIRM WITH MORE THAN 999 EMPLOYEES

Proportion

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

Hishokukai
Kakaricho
Kacho
Bucho

20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-
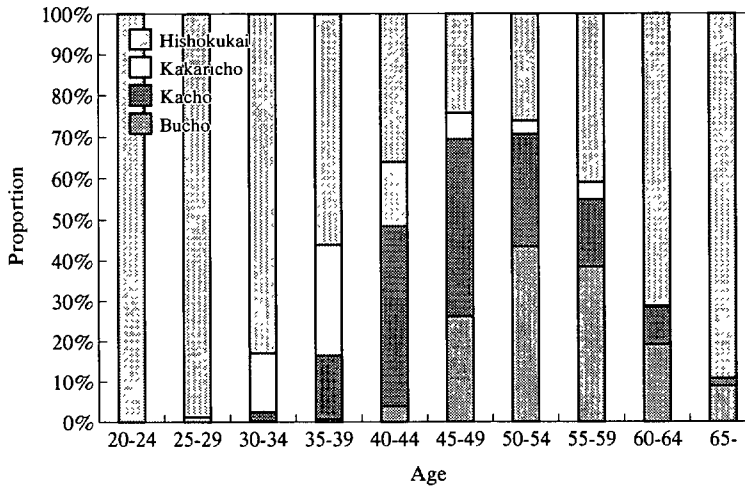
Age

Source: Basic Survey of Wages
Note: Bucho: Division manager
Kacho: Subdivision manager
Kakaricho: Section chief
Hishokukai: Others (Non-managerial positions)

FIG. 2 PROPORTION OF EMPLOYEES IN EACH RANK IN 1990
MALE GRADUATES IN FIRM WITH MORE THAN 999 EMPLOYEES

Proportion

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

Hishokukai
Kakaricho
Kacho
Bucho

20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60-64 65-

Age

Source: Basic Survey of Wages
Note: Bucho: Division manager
Kacho: Subdivision manager
Kakaricho: Section chief
Hishokukai: Others (Non-managerial positions)

FIG. 3   PROPORTION OF EMPLOYEES IN EACH RANK IN 1984
         MALE GRADUATES IN FIRM WITH MORE THAN 999 EMPLOYEES
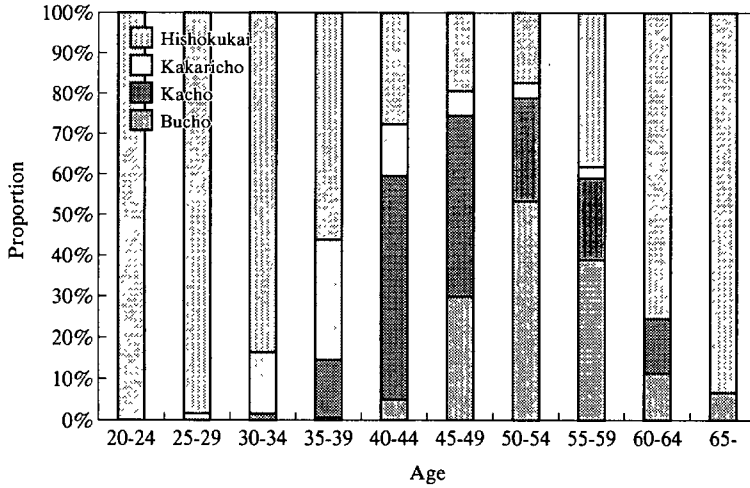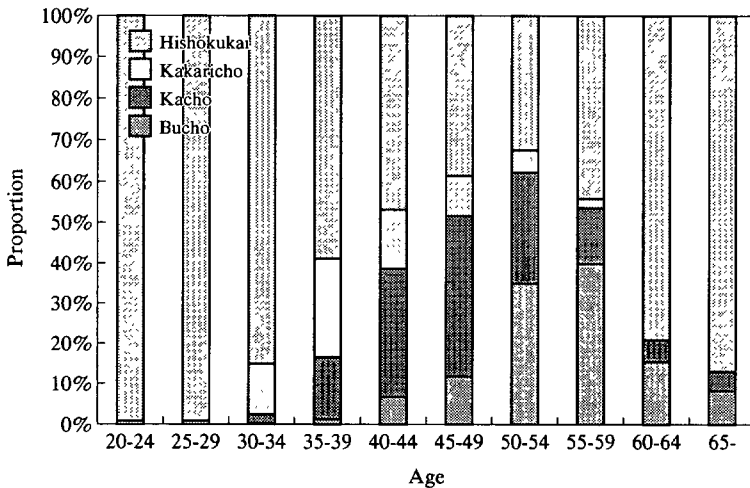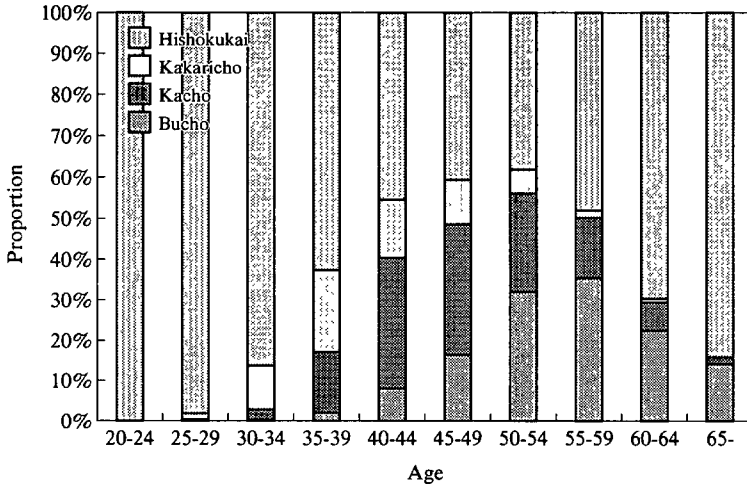

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

FIG. 4   PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
         MALE GRADUATES IN FIRM WITH 500-999 EMPLOYEES

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

FIG. 5   PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
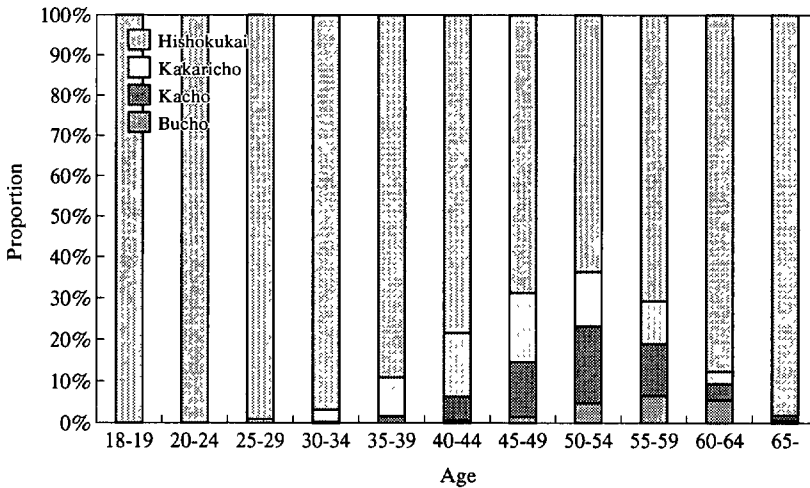   MALE GRADUATES IN FIRM WITH 100-499 EMPLOYEES

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

FIG. 6   PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
         MALE HIGH SCHOOL GRADUATES IN FIRM WITH 999 EMPLOYEES

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

FIG. 7 PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
MALE HIGH SCHOOL GRADUATES IN FIRM WITH 500-999 EMPLOYEES

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

FIG. 8 PROPORTION OF EMPLOYEES IN EACH RANK IN 1998
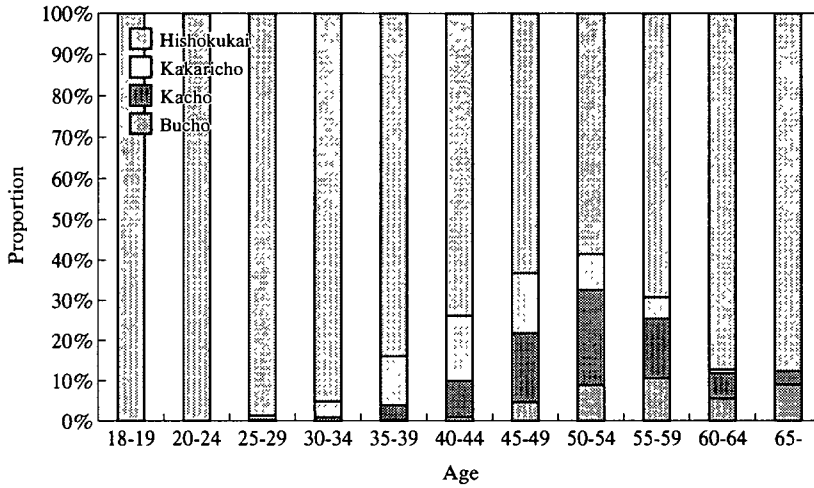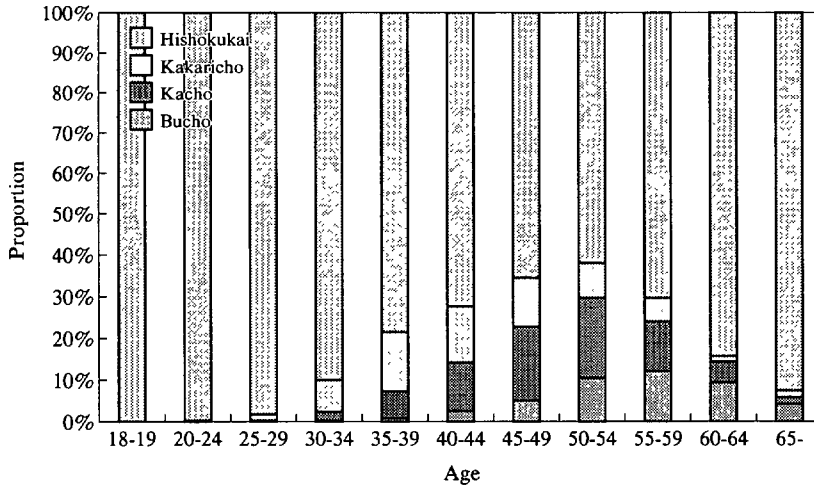MALE HIGH SCHOOL GRADUATES IN FIRM WITH 100-499 EMPLOYEES

Source: Basic Survey of Wages
Note: Bucho: Division manager
      Kacho: Subdivision manager
      Kakaricho: Section chief
      Hishokukai: Others (Non-managerial positions)

1 is for companies with more than 999 employees. The data shown in these figures suggest that promotion speed was not related to company size.

Figs 6-8 show similar figures for high school graduates. One striking feature is that the proportions of those in higher ranks (*Bucho*, *Kacho* and *Kakaricho*) are much smaller compared with university graduates in Fig. 1, 4 and 5, which correspond to Figs 6-8. It is also shown that the speed of promotion is much slower for high-school graduates. Typically, they are promoted to *Kakaricho* around 35-39 years old, and become *Kacho* around 40-45, and are promoted to *Bucho* at the age of 50-54 years.

VI.   *Rank and Pay*

In this section, we examine the pay gap between employees in different ranks in the firm. In particular, we estimate the following wage function to test our hypothesis 1.

Wage = f(age, sector dummies, rank dummies, year)

By estimating this function, we test our hypothesis that the pay gaps between employees in adjacent layers of the company hierarchy are larger as an employee climbs up the corporate ladder. The above hypothesis implies that the coefficient for each rank is larger for higher ranks.

Table 2 shows the results of the regression analysis. One of the most striking features of this table is that coefficients for rank are larger for the higher ranks. Each coefficient shows the difference from *Bucho*. As *Bucho* is the top rank, all coefficients are negative. The coefficient for *Kacho* in equation 1 is −17,314.94, showing that Kacho receives 1,731,494 yen less than *Bucho* Because the coefficient for *Kakaricho* is −30,348.61, the difference between *Kacho* and *Kakaricho* is −13,033.67, showing the pay gap is 1,303,367 yen.[4] Similarly, the difference between *Kakaricho* and others (non-managerial positions) is −12,447.75. These figures show that the pay gaps between employees in adjacent ranks become larger for higher ranks. Similarly, the pay gap between *Bucho* and *Kacho* is larger than other pay gaps in lower ranks in equation 2 and equation 3.[5] In other words, the pay gaps between employees in adjacent ranks are likely to be large for employees in higher ranks. This result is consistent with our hypothesis, which is implied by tournament theory.

VII.   *Pay Gap and Promotion*

We examine the relationship between pay gap and promotion probability in this section, to test the hypothesis that the pay gap between employees in adjacent ranks is negatively correlated with the possibility that an employee in a lower rank can be promoted to the upper level. We estimate the determinants of the pay gap to test this hypothesis. Pay gap is defined as the ratio of average wages received by employees in adjacent ranks, such as *Bucho* and

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[4] The difference between *Kacho* and *Kakaricho* can be calculated by deducting the coefficient of *Kacho* (−17,314.94) from that of *Kakaricho* (−30,348.61).

[5] However, in equation 4, the pay gap between *Kacho* and *Kakaricho* is slightly larger than that between *Bucho* and *Kacho*. This result may be because bonus reflects performance of the firm.

TABLE 2. DETERMINANTS

Dependent Variables	Eq. 1			Eq. 2		
	Total salary			Monthly pay Incl. overtime		
	Coef.	t-value	P > |t|	Coef.	t-value	P > |t|
Kacho	−17314.940	−30.903	0.000	−1002.962	−36.849	0.000
Kakaricho	−30348.610	−52.885	0.000	−1925.237	−69.061	0.000
Foreman	−35007.570	−51.362	0.000	−2259.677	−68.247	0.000
Others	−42796.360	−86.324	0.000	−2543.262	−105.602	0.000
age	86.576	97.308	0.000	4.863	112.508	0.000
manufacturing	−1602.541	−4.337	0.000	−225.125	−12.543	0.000
electricity, etc.	−2309.150	−2.545	0.011	−26.962	−0.612	0.541
transport, etc.	6266.396	4.132	0.000	204.627	2.778	0.005
wholesale, etc.	−1211.300	−2.987	0.003	−2.697	−0.137	0.891
finance, etc.	10315.890	19.569	0.000	432.163	16.876	0.000
services	904.453	2.210	0.027	19.277	0.970	0.332
size (500−999)	−8519.333	−29.939	0.000	−353.957	−25.606	0.000
size (100−499)	−14480.780	−70.956	0.000	−573.030	−57.800	0.000
year	474.899	21.474	0.000	31.894	29.688	0.000
constant	−876415.600	−19.905	0.000	−59543.330	−27.839	0.000
Sample size	8979			8979		
Adjusted R^2	0.821			0.858		

The coefficients for *Kacho*, *Kakaricho*, Foreman, and others show the difference in salary (100yen) from *Bucho*.
The coefficients for sectors show the difference from construction.
The coefficients for sizes show the difference from size (999-max).
Size (999-max) applies to firms whose number of employees is larger than 999.
Bucho, *Kacho*, and *Kakaricho* correspond to division manager, subdivision manager and section chief.

Kacho. Independent variables include the ratio of number of employees in adjacent ranks (RNOE), i.e., the number of *Bucho*/the number of *Kacho*. We use this ratio as the proxy for employee's possibility for promotion as many employees in managerial position in Japanese companies are promoted internally [Tomita (1992); Hanada (1993)].

Pay gap = f(RNOE, year, size dummies, sector dummies, age)

Pay gap = average wage of rank t / average wage of rank t − 1
RNOE = ratio of employees in rank t and rank t − 1
Age = average age of employees[6]

Table 3 shows the result of this regression.[7] The most striking feature in this table is that all the coefficients for RNOE are negative and significant, as our hypothesis predicts. In other words, pay gap is larger when employees see little chance of being promoted. According to tournament theory, this negative relationship between pay gap and promotion possibility may

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[6] It should be noted that we use aggregate data in the estimation of this equation. We obtained these data on pay gap, RNOE, etc., for each size, sector, and age band. We used average age of employees in rank t − 1 in our regression as age variable. As both employees in rank t and in rank t − 1 belong to the same age band, the average age of those in rank t and in rank t − 1 may be almost the same.

[7] We excluded samples whose numbers of employees in rank t are larger than those in rank t − 1. We also excluded those samples whose average wages of rank t are smaller than those in rank t − 1.

OF SALARY

| Eq. 3 | | | Eq. 4 | | |
| Monthly pay excl. overtime | | | Bonus | | |
Coef.	t-value	P > |t|	Coef.	t-value	P > |t|
−972.809	−32.767	0.000	−5641.231	−25.242	0.000
−1545.159	−50.815	0.000	−11806.700	−51.582	0.000
−1689.734	−46.787	0.000	−14730.760	−54.185	0.000
−2181.057	−83.027	0.000	−16623.680	−84.067	0.000
4.924	104.457	0.000	27.483	77.445	0.000
−127.760	−6.526	0.000	−69.427	−0.471	0.638
−188.382	−3.919	0.000	−48.569	−0.134	0.893
102.937	1.281	0.200	5031.155	8.317	0.000
−126.109	−5.868	0.000	302.004	1.867	0.062
363.201	13.003	0.000	5957.478	28.333	0.000
13.645	0.629	0.529	740.709	4.537	0.000
−426.154	−28.263	0.000	−3405.484	−30.004	0.000
−706.440	−65.328	0.000	−6003.506	−73.752	0.000
29.335	25.035	0.000	122.874	13.930	0.000
−54379.000	−23.309	0.000	−223867.500	−12.747	0.000
8979			8979		
0.818			0.802		

If the coefficient is −17314.94, *Bucho* earns 1,731,494 yen more than *Kacho*.

motivate employees to work hard, as employees can expect large reward by wining the competition.

VIII. *Summary and Conclusions*

The purpose of this paper is to analyse the relationship between promotion and pay gaps between employees in adjacent layers of firms, i.e., between *Bucho* (division manager) and *Kacho* (subdivision manager).

One of our main hypotheses is that there is a negative relationship between pay gap and the possibility that an employee is promoted. This hypothesis is implied by rank order tournament theory [Lazear and Rosen (1981); Lazear (1991, 1995)], which suggests that, if the probability for promotion for each employee is small, the pay gap needs to be large to motivate employees. Thus, it is considered that a negative correlation exists if the company uses a tournament type pay structure. In addition, we tested whether pay gaps between employees in adjacent layers of the firm become larger as an employee climbs up the corporate ladder. According to the theory, as the competition to be promoted is more intense as the person goes up the corporate hierarchy, the reward for being promoted should be larger.

Our results can be summarized as follows. Firstly, it was found that the pattern of promotion has been unchanged since 1984. Particularly, the speed of promotion is almost the

TABLE 3. DETERMINANTS OF PAY GAP BETWEEN EMPLOYEES IN ADJACENT RANKS

Dependent Variables	Eq. 1 gap0102			Eq. 2 gap0203			Eq. 3 Dependent		
	Coef.	t-value	P > |t|	Coef.	t-value	P > |t|	Variables	gap0310	Coef.
RNOE0102	−0.126	−3.099	0.002						
RNOE0203				−0.155	−4.004	0.000			
RNOE0310							−0.667	−17.065	0.000
year	−0.002	−1.110	0.267	0.001	0.594	0.553	−0.003	−2.844	0.005
age	0.000	2.430	0.015	0.001	6.094	0.000	0.000	9.745	0.000
size (500-999)	0.038	1.995	0.046	−0.018	−0.859	0.391	−0.004	−0.345	0.730
size (100-499)	0.052	2.745	0.006	0.018	0.894	0.372	0.002	0.175	0.861
manufacturing	0.013	0.492	0.623	0.008	0.290	0.772	0.017	1.179	0.239
electricity, etc.	−0.028	−0.385	0.700	−0.045	−0.633	0.527	−0.017	−0.420	0.675
transport, etc.	0.058	0.880	0.379	0.065	0.906	0.365	0.078	1.743	0.082
wholesale, etc.	0.047	1.794	0.073	0.024	0.905	0.366	−0.005	−0.300	0.764
finance, etc.	0.140	5.250	0.000	0.161	5.919	0.000	0.076	4.702	0.000
services	0.173	6.867	0.000	0.090	3.394	0.001	−0.070	−4.560	0.000
constant	5.056	1.404	0.161	−1.364	−0.354	0.723	7.514	3.345	0.001
Sample size	1009			573			1646		
Adjusted R²	0.076			0.126			0.219		

Gap0102: Pay gap between *Bucho* and *Kacho*
Gap0203: Pay gap between *Kacho* and *Kakaricho*
Gap0310: Pay gap between *Kakaricho* and others (non-managerial positions)
RNOE102: Ratio of number of *Bucho* and that of *Kacho*
RNOE203: Ratio of number of *Kacho* and *Kakaricho*
RNOE0310: Ratio of number of *Kakaricho* and others (non-managerial positions)

The coefficients for sizes show the difference from size (999-max).
Size (999-max) applies to firms whose number of employees is larger than 999.
The coefficients for sectors show the difference from construction.

Bucho, *Kacho*, and *Kakaricho* correspond to division manager, subdivision manager and section chief.

same, comparing 1984 and 1998 data. Secondly, we found that the pay gaps between employees in adjacent layers of the firm become larger as one goes up the corporate hierarchy.[8] Thirdly, this research found a negative relationship between the pay gap and ratio of employees in adjacent ranks, which shows the promotional opportunities of workers in Japan, supporting our hypothesis. This result is in line with our argument that a rank order tournament type pay system is used in large Japanese companies. In addition, our results are basically consistent with previous studies in the USA, though our analysis focuses on the hierarchy of employees, rather than on that of directors [Main et al. (1993); Demsetz (1995)].

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[8] Equations 3 and 4 in Table 2 show that there are some cases where the pay gap is slightly smaller than that in lower ranks. For example, in equation 4, the difference in bonus between *Bucho* and *Kacho* is slightly smaller than that between *Kacho* and *Kakaricho*.

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