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Cohort Size Effects on Promotion and Pay: Evidence from personnel data (Revised)

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Cohort Size Effects on Promotion and Pay: Evidence from personnel data

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Abstract

This paper provides econometric evidence on the cohort size effect in promotion and pay using detailed personnel records of all workers who joined two large manufacturers in Japan during the period 1991-2010. We find that entering the labor market when the economy is in a bad year and joining firms with fewer colleagues increase the probability of promotion and pay. Our finding implies that the cohort can be a reasonable proxy for the contestant pool.

Keywords : Internal labor market, Entry point, Cohort, Career, Competition, Selection
JEL classification : J24, M5

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This study is conducted as a part of the Project ”Economic Analysis of Human Resource Allocation Mechanisms Within the Firm: Insider econometrics using HR data” undertaken at Research Institute of Economy, Trade and Industry (RIETI).

I. Introduction

This paper provides the first econometric evidence on the cohort size effect in promotion and pay -- the long-term effect on career success (promotion and pay) of entering the labor market in bad economies and joining the firm with a fewer colleagues (reduced cohort size). In so doing, we take advantage of our unusual access to detailed personnel records of all workers who joined two large manufacturing companies (hitherto called companies A and B) in Japan during 1991-2010. Most importantly in addition to standard personnel data on each worker, our data contain data on the size of the clearly-defined entry cohort (the number of all workers who joined the two firms as new college graduates in the same year) along with each worker's job grade level and annual subjective evaluation in each subsequent year. Such cohort size effects are particular relevant to many workers who land jobs in large firms with well-developed internal labor markets because the cohort size may determine the size of contestant pool for promotion tournament.

We estimate an ordered probit model of job grade levels, and find evidence for the counter-cyclical cohort size effects – entering the labor market in a bad year and joining the firm with a fewer colleagues will actually help the worker succeed in her future career development with a higher probability of promotion. Such counter-cyclical cohort size effects remain to be found even after accounting for the selection effect that workers belonging to smaller cohorts are selected from better schools. Our finding implies that the cohort can be a reasonable proxy for the contestant pool.

Our study was motivated in part by one of the most pressing policy questions facing the U.S. and other advanced market economies -- to assess the long-term effects of the financial meltdown in the fall of 2008 and the subsequent Great Recession on the economic, political, and social life of the country. To respond to the urgent need to inform policy makers on such an important issue, researchers have been undertaking a variety of research projects. A major challenge for such undertakings is the lack of data which cover a sufficiently long time period and hence enable researchers to assess the long-term consequences of the Great Recession. After all, it has been only a few years since the Great Recession began.

Fortunately, there was another Great Recession across the Pacific two decades ago. At the end of 1980s, the financial and real estate bubble were burst rather violently in Japan, which set the country into a prolonged economic stagnation, or the "Lost Decade". Notwithstanding some important differences between Japan's lost decade and the Great Recession, there are some intriguing similarities (Koo, 2008). A number of serious attempts have been made to contrast the Great Recession to Japan's "Lost Decade" in the 1990s, in search for historical lessons with regard to the causes and consequences of such severe and prolonged recession as well as appropriate policy responses (see, for instance, Hamada, Kashyap, and Weinstein, 2011 and Hoshi and Kashyap, 2010).

Specifically our data will enable us to study career development of each worker over fifteen years since he/she joined the firm in the midst of Japan's Great Recession (mid-1990s). On our reading of the literature, this is the first evidence on the long-term career effects of labor market entry during either Japan's Great Recession or the recent global Great Recession.

The next section provides theoretical discussions on a mechanism through which the cohort size can affect a worker's career development, along with a brief review of the relevant literature. In Section III we describe our data, followed by the empirical strategy and results. The concluding section will highlight the major findings and discuss their implications.

II. Cohort, Cohort Size, and Career

There is a rich literature on the long-term employment effects of labor market entry conditions. Such cohort effects are analyzed theoretically by Beaudry and NiNardo (1991) and Gibbons and Waldman (1999, 2006). Much of the empirical literature on cohort effects focuses on the effect on wages of entering the labor market in recession (e.g., Oyer, 2006, von Wachter and Bender, 2006, Kahn, 2010, and Genda, Kondo and Ohta, 2010). On our reading of the literature, Kwon, Milgrom and Hwang (2010) is the only study to examine cohort effects on long-term career development (promotion). The case study part of their paper is probably the closest to our paper.

In short, the cohort effect literature focuses on the long-term effect on labor market outcomes of entering the labor market in recession. One immediate consequence of entering the labor market in recession (in particular, the Great Recession which Japan experienced two decades ago and the U.S. and Europe also experienced recently) for those who manage to land a full-time regular job is a reduced size of her cohort at the firm. The literature has not examined the long-term effect on career success (promotion and compensation) of entering the firm with a fewer colleagues who belong to the same cohort. This paper focuses on this particular aspect of entering the labor market in a bad year, or the long-term effects on career development of entering the firm with a fewer colleagues who belong to the same cohort at the firm.

To the extent to which the cohort serves as a primary contestant pool for promotion tournament, the size of the cohort will have a direct impact on a worker's promotion prospect. Consider a worker who lands a job in a firm with well-developed internal labor markets in which workers on the same track are hired into a specific port of entry and climb a well-defined promotion ladder; and accumulate human capital mostly though on-the-job training (Doeringer and Piore, 1971). For such a worker, entering the labor market in bad economies means entering the firm with a fewer colleagues who belong to the same cohort and hence the same contestant pool for promotion tournament. In other words, she has a smaller cohort and her contestant pool for promotion tournament is smaller than her counterparts who enter the firm in good economies. It follows that insofar as the firm uses the cohort as a primary contestant pool for promotion tournament, entering the labor market in recession will be actually beneficial for a worker's promotion prospect. In other words, there is a negative correlation between the odds of promotion and the cohort size, and therefore the worker who enters the firm in a bad year and hence belongs to a smaller cohort tends to enjoy greater odds of promotion than her counterparts who enter the firm in good years.

We conjecture that the effect is particularly relevant and important for those in firms with well-developed internal labor markets in Japan. First, in promotion tournament in large Japanese organizations in Japan, the cohort is normally considered the primary contestant pool for promotion tournament. For instance, according to Koike (2005), all workers recruited to the same track (say, the engineering track) by the firm in the same year tend to climb the promotion ladder at the same speed for the first few years. However, thereafter workers in the same cohort started to move up the promotion ladder at different speeds.

The alternative hypothesis concerning selection also predicts a negative effect on the promotion probability of the cohort size. The firm may take advantage of excess supply of high-quality graduates in bad economies, and succeed in attracting more high-quality job applicants than in good economies. If promotion is not strictly cohort-based and there is substitution between neighboring cohorts, a worker entering the firm in a bad year is likely to be higher-quality and hence climb up the promotion ladder more quickly. The remainder of the paper represents our attempt to remove such a selection effect using detailed information on educational credentials of each worker (specifically the prestige and ranking of her alma mater).

III. Personnel Data from Two Large Manufacturing Firms

Company A is a large multinational firm with its headquarters located in Tokyo, employing about 8,000 workers in Japan and well over 20,000 workers worldwide as of March 2010. The firm produces and supplies machine parts to other manufacturing firms. Company B is a large manufacturing company that employs 6,000 workers in Japan and well over 20,000 workers worldwide. [1]

For each firm the dataset consists of detailed payroll information and evaluation records as well as the history of job assignments for all workers who ever worked for the firm's Japanese plants including the headquarters during 1991-2010. Important employee characteristics available in the dataset include gender, age, tenure, and

[1] Our confidentiality agreement with each firm prohibits us from revealing further details on their product lines.

educational credentials (notably the name of each employee’s alma mater).

As in the case of many Japanese firms during Japan’s prolonged stagnation following the burst of the bubble, Company A downsized its labor force substantially (its employment level fell by 35% from 1992 through 2004). Such significant downsizing has been achieved in large part by hiring cuts, as shown below. In spite of its turbulent business environment, the company largely maintained its job structures and main human resource management policies.

Between 1991 and 2010, roughly 40% of new hires had college degrees or higher and about a half of them were “shinsotsu saiyo (new graduates hires)” who entered the firm immediately following graduation. For the present study, we focus on this group—new college graduate hires. Traditionally for Japanese firms with well-developed internal labor markets, the regular contestant pool for promotion tournament is comprised of such new graduate hires. Anyone who is hired in the same year yet not a new graduate hire is termed as a “chuto saiyo (mid-career hire)” and is considered a member of the same contestant pool as new graduate hires.[2]

Figure 1 shows the cohort size of new college graduates for each entry year of Company A. The complete personnel records for all employees at Company A are available from 1991. As shown in the figure, the cohort size started to shrink rather drastically in 1994 — less than half of the peak mainly due to a negative demand shock to the company. After four years of “hiring freeze”, the cohort size rebounded in 1998. After year 2000, the number of new hire was on a growing trend until the financial crisis of the fall of 2008, which resulted in a drop in the cohort size in 2009.

[2] See, for instance, Ono (2010) and Kambayashi and Kato (2011).

Table 1 reports the descriptive statistics of analysis data from Company A. The analysis sample contains about 85,000 person-month observations covering the period between January 1991 and December 2010. All university graduate employees who ever worked at Company A during the sample period are included. During the period, the cohort size varies between 14 and 117 reflecting the boom and bust periods of the company as we have already seen in Figure 1. The average cohort size is about 65 and female workers consist of only 4%. The maximum years of job tenure in the analysis sample is 19 years because the sample covers between 1991 and 2010. Company A uses a fairly standard job grade system, and there are nine job grade levels from 1st Grade to 2nd Grade to 3rd Grade, and then to Vice Supervisor to Supervisor to vice Manager, and finally to Manager.

Figure 2 shows the number of new college graduate hires for Company B. Company B also implemented rather drastic hiring cut--in early 1990's the firm hired about 300 new college graduate yet the firm imposed a rather severe hiring cut and by 1995, the number of new college graduate hires fell to about 50. The number of new college graduate hires fluctuated between 50 and 100 until the company imposed a complete hiring freeze in 2003. Since then, the company steadily increased new college graduate hires until it was hit by the financial crisis in 2008. As many other Japanese companies, Company B recruits new graduates one year ahead of university graduation. Therefore, the adverse shock of the financial crisis first appears in 2010.

Table 2 reports the descriptive statistics for Company B. On average the cohort size is around 145, substantially larger than Company A. Female workers consist of 12% of the analysis sample. Company B adopts a standard job grade system. All entrants are hired as J1 and promoted to J2. Then they are promoted to SA, SB and then to G6 and finally to G3. About a quarter of workers in the analysis sample graduated from 1st tier national universities. This high skill composition of work force reflects the skill-intensive products of the company.

IV. Empirical Strategy and Results

Our empirical strategy is similar to Kwon, Milgrom and Hwang (2010) except that we use the direct measure of the cohort size rather than the cohort dummy variables as used by Kwon, Milgrom and Hwang (2010). Thus, to examine the cohort size effect on promotion, we estimate an ordered probit model of the worker's job grade level as a function of her cohort size as well as her tenure and gender.[3]

In the ordered probit analysis, we ignored one type of outcome, exit from the firm (or separations). If the probability of exit is correlated with cohort size, ignoring this option will pose potential bias on our estimates. Fortunately, as shown in Table 3 and Table 4, our estimation of a probit model of the probability of exit as a function of cohort size and other controls confirms that the estimated marginal effect on the probability of exit of cohort size is small and highly insignificant for both Company A and Company B, suggesting that ignoring the exit outcome may not pose serious bias for both cases.[4]

To address the selection effect, we consider the university quality dummy variables as additional controls in our ordered probit model. Specifically, based on one of the most widely used university ranking in Japan--the Yoyogi-seminar's university ranking (http://www.yozemi.ac.jp/rank/gakubu/index.html), we group all universities

[3] We also estimated a proportional hazard model with Weibull distribution as an alternative to ordered-probit and reassuringly found no discernible changes in our key conclusions.

[4] Though it is clearly beyond the scope of the paper, women are found to be significantly more apt to exit than men.

into the following six categories1st Tier National Univ., 2nd Tier National Univ., 3rd Tier National Univ., 1st Tier Private Univ., 2nd Tier Private Univ., and 3rd Tier Private Univ.

The estimated coefficients on cohort size and the resultant marginal effect estimates for Company A are reported in Table 5. The estimated coefficient on cohort size is negative and highly significant, pointing to the overall positive effect on promotion of entering the firm in bad economies and belonging to a smaller cohort group. To assess the economic significance of the cohort size effects, we use the marginal effect estimates and conduct the following thought experiments. First, consider the largest difference in the cohort size during the sample period – a drop in the cohort size from 124 to 24. The probability of being appointed to 3rd Grade will rise by about 8 percentage points. The sample mean of the probability of being appointed to 3rd grade is 17 percent. A drop in the cohort size from 124 to 24 represents near-doubling of the probability of appointment to 3rd Grade. However, this ought to be considered an upper bound for the size of the cohort size effects. Alternatively we consider one standard-deviation drop in cohort size (27.7). The probability of appointment to 3rd Grade will rise by almost 4 percentage points. Comparing to the sample mean of 17 percent, the estimated size of the cohort size effect is hardly negligible.

Table 6 reports the estimated coefficients of the ordered probit model for Company B. The estimated coefficient on the cohort size is negative and statistically significant as in the case of Company A. Again, to access the economic significance, we consider the effect of the one standard deviation (86.85) drop of cohort size on the probability of promotion to Rank 6 (G5). Using the marginal effect estimates, the drop reduces the odds of promotion to Rank 6 by 0.43 percentage points. Comparing the sample mean of 24% the effect is about 2%. While the size of the effect is smaller than that of Company A, the estimated effect is still not entirely negligible.

In sum, our ordered-probit estimates suggest that the overall direction of the cohort size effect is counter-cyclical – entering the firm in economic downturn actually helps career development in terms of promotion rates because of the smaller size of the contestant pool for promotion tournament.

Our finding of the counter-cyclical cohort effect in promotion is in stark contrast to Kwon, Milgrom and Hwang (2010) who conduct a similar econometric case study of a U.S. firm, and uncover a pro-cyclical cohort effect in promotion. Notwithstanding the methodological difference (the use of the cohort size in our study vs. the use of the cohort dummy variables in their study), we conjecture that institutional differences in promotion tournament between the U.S. and Japan may account for the discrepancy. Specifically the contestant pool is more rigidly defined according to the year of entry to the firm in Japan than in the U.S., and hence the cohort size is tied to the size of the contestant pool more strictly in Japan than in the U.S. Furthermore, Japan's celebrated "long-term" employment system makes it difficult for outsiders to compete for mid-level management positions in large firms in Japan (for Japan's long-term employment and its recent changes, see, for example, Ono, 2010, Kambayashi and Kato, 2011 and Kawaguchi and Ueno, 2013). As such, the size of the contestant pool reflects the cohort size more strongly in Japan than in the U.S.

As discussed above, much of the cohort effect literature focuses on the cohort effect on wages rather than promotion. We now extend our analysis to consider wages. Unlike most prior studies, however, we are focusing on a specific venue through which labor market entry in bad economies affects subsequent wages—promotion tournament. We have just shown that starting the first job in recession leads to higher odds of promotion. As such, we expect that those workers who enter the labor market in recession and have a fewer colleagues in the same cohort (smaller cohort size) are more likely to get promoted and hence earn higher wages subsequently in general.

However, at the same time, since the long-term wage gains for workers entering the labor market in bad economies stem from promotion to higher job grade levels with a pay increase, once job grade levels are effectively controlled for, such wage gains for workers in a smaller cohort will likely disappear. In fact, in theory, workers in a smaller cohort enjoy higher odds of promotion and therefore tolerate a smaller prize of tournament (i.e., promotion is accompanied by a smaller pay raise).[5] As such, once job grade levels are controlled for, workers in a smaller cohort might be even shown to earn less than workers in a larger cohort although such a frequent change in the prize size may prove to be impractical.

Table 7 shows for Company A the OLS estimates of a standard Mincerian wage equation augmented by the cohort size variable--log of monthly wage as a function of cohort size, gender, tenure, and year dummy variable.

Without controlling for university quality and job grade levels, as shown in column (1) of the table, the estimated coefficient on cohort size is negative and highly statistically significant. As we did in our analysis of the cohort size effect in promotion, we assess the economic significance of the estimated coefficients on cohort size by carrying out two simulations. First, a drop in the cohort size from 124 to 24 (the largest difference in the cohort size during the sample period) will lead to an increase in wage by 1.8 percent. Again, this is an upper bound for the cohort size effect in wage. Alternatively one standard-deviation drop in cohort size (27.7) will result in a less than

[5] See, for instance, Lazear and Rosen (1981), Eriksson (1999), and Kato and Long (2011).

1 percent of wage increase.

When the selection effect based on school quality is removed by adding a set of school quality dummy variables, the estimated coefficient on cohort size remain negative and highly significant statistically yet the size of the coefficient falls from 0.0018 to 0.0012. When the overall cohort size effect in promotion is accounted for (by including job grade levels as an additional control), as expected, the absolute value of the estimated coefficient on cohort size falls further down to 0.0006 although the coefficient on cohort size is still precisely estimated.

We repeat the same analysis for Company B and report the results in Table 8. The estimated coefficient on cohort size is negative but statistically not significant as reported in column (1). The size of coefficient and statistical significance further decreases after adding a set of school quality dummy variables as reported in column (2). The sign of estimated coefficient on cohort size changes after adding a set of rank and evaluation dummy variables, which is not entirely implausible in light of the tournament theory predicting a positive correlation between the size of the contestant pool and the size of the prize, as discussed earlier.

To summarize, evidence on the cohort size effect on wages appears to be weaker than that on the cohort size effect on promotion—the estimated cohort size effects on wages are either insignificant or significant statistically yet rather small. The Japanese bonus payment system has attracted considerable attention and controversy, in particular the debate between those who argue that bonus is simply a disguised regular wage and that it is introduced largely for tax advantages and those who stress distinct roles that the bonus payment system plays in Japan.[6] The long-standing debate over the nature of

[6] For the debate, see for example Freeman and Weitzman (1987), Ohashi (1989), Hashimoto

the Japanese bonus system can also apply to the cohort size effect. If bonus is simply a disguised regular wage, on the one hand, we should expect to find somewhat weak and mixed evidence on the cohort size effect on bonus. . On the other hand, if bonus represents a prize for promotion tournament, we may find a larger cohort size effect in bonuses (Krakel, 2003).

We repeat the same analysis as summarized in Table 7 and Table 8, using log of annual bonus instead of log of monthly wage as the dependent variable. The results are presented in Table 9 and Table 10. As shown in Table 9, for Company A, the estimated coefficients on cohort size are negative and statistically significant as in the case of monthly wages. The magnitude of the cohort size effect in bonus is, however, considerably larger – without removing the selection effect (or the college quality effect), the decline in the cohort size from 124 to 24 (the largest difference in the cohort size during the sample period) will lead to an increase in annual bonus by 3.5 percent; and one standard-deviation drop in cohort size (27.7) will result in a 1-percent increase in bonus again as expected, removing the selection effect by adding school quality dummy variables, the magnitude of the cohort size effect will fall considerably.

As in the case of wage, once job grade levels are properly controlled for, the negative cohort size effect disappears (in fact the estimated coefficient turns slightly positive), as shown in column (3). As such, our cohort effect estimates on bonus support the tournament theory as applied to the cohort size effect. At the same time, they do not immediately support the view that the Japanese bonus system is disguised wages, for the magnitude of the cohort size effect (when promotion is not accounted for) appears to be considerably larger for bonus than for wage. The results are more congruous with the

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(1990), Brunello (1991), Hart and Kawasaki (1999), Krakel (2003), and Kato and Kubo (2006).

more recent view that bonus in Japan is a prize for promotion tournament. We repeat the same analysis for Company B. The OLS estiamtes are summarized in Table 10. The contrast in the cohort size effect between wage and bonus is even sharper here, providing even more credence to the tournament view on Japanese bonus payment system—bonus as a tournament prize. Specifically contrary to the result for the monthly wage equation in Table 8, the estimated coefficient on the cohort size is now negative and statistically significant. The magnitude of the cohort size effect is notable--the decline in the cohort size from 309 to 47 (the largest difference in the cohort size during the sample period) will lead to an increase in annual bonus by 5.2 percent; and one standard-deviation drop in cohort size (86.85) will result in a 1.7 percent increase in bonus. As anticipated, the magnitude of the cohort size effect falls considerably when we account for school quality dummy variables as shown in column (2). Perhaps more importantly, again to be consistent with the tournament theory as applied to the cohort size effect, the absolute value of the estimated coefficient on cohort size falls considerably once job grade levels (or promotion) are controlled for.

V. Conclusions and Policy Implications

This paper has provided the first econometric evidence on the cohort size effect in promotion and pay -- the long-term effect on career success (promotion and pay) of entering the labor market in bad economies and joining the firm with a fewer colleagues (reduced cohort size). In so doing, we have taken advantage of our unusual access to detailed personnel records of all workers who joined large manufacturers (Companies A and B) in Japan during 1991-2010. Most importantly in addition to standard personnel data on each worker, our data contain data on the size of the clearly-defined entry cohort (number of all workers who joined Company A and Company B as new college graduates in the same year) along with each worker's job grade levels and annual subjective evaluation in each subsequent year.

Such cohort size effects are particular relevant to many workers who land jobs in large firms with well-developed internal labor markets and develop their careers within the firm. We argue that contracted cohort size strengthens a worker's future career development through promotion within the firm because workers in such a cohort benefits from a smaller contestant pool for promotion tournament (and hence higher odds of promotion).

We have estimated an ordered probit model of job grade levels, and have found evidence for the counter-cyclical cohort size effects – entering the labor market in a bad year and joining the firm with a fewer colleagues will actually help the worker succeed in her future career development with higher odds of promotion. Such counter-cyclical cohort size effects are consistent with our view that the entry cohort size can be considered the size of the contestant pool for promotion tournament in large firms with well-developed internal labor markets. We have also confirmed that our key results change little even when we account for the selection effect—higher-quality individuals recruited in bad economies (and hence slack labor market).

Methodologically, the finding for counter-cyclical cohort size effects can be good news for applied researchers who conduct empirical studies of promotion tournament within the firm. One of the major obstacles to such applied work is the lack of a reliable proxy for the contestant pool for promotion tournament. Our finding implies that the cohort can be used as a reasonable proxy for the contestant pool.

Policy makers around the world face a challenge of assessing the long-term effects of the financial meltdown in the fall of 2008 and the subsequent Great Recession on the economic, political, and social life of each country, and develop effective policy responses. Unfortunately it has been only several years since the current Great Recession started. As such we do not have sufficiently long data to carry out such a long-term impact assessment. This paper has taken advantage of the fact that Japan experienced an equally severe and prolonged economic stagnation two decades ago.

We have found that new college graduates (who finished colleges and joined the labor market in the midst of Japan's Great Recession) actually benefitted from the cohort effect in promotion as a result of her reduced cohort size. Japan's Great Recession has been found to have little negative long-term effects on career of those who entered the labor market AND found jobs in the midst of the severe downturn. Our findings imply that the burden of Japan's Great Recession in terms of labor market outcomes was probably borne mostly by those who entered the labor market during the Great Recession AND failed to find regular jobs.

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Table 1 Descriptive Statistics of **Company A, College Graduate White Collar, 1991-2010, Wages Only Available 2003 and After**

Variable(Company A)	N	Mean	Std. Dev.	Min	Max
Cohort Size	85339	64.56	27.70	24	124
Female	85339	0.04	0.03	0	1
Tenure	85339	6.58	5.44	0	19
Monthly Wage	85339	254963	123897	0	451700
Annual Bonus	5160	754387	340243	5000	2239000
Job Grade Level					
1st Class	85339	0.38	0.48	0	1
2nd Class	85339	0.21	0.40	0	1
3rd Class	85339	0.17	0.38	0	1
Vice Supervisor	85339	0.14	0.35	0	1
Supervisor (Shusa)	85339	0.07	0.25	0	1
Vice Manager (2)	85339	0.02	0.15	0	1
Vice Manager (1)	85339	0.004	0.06	0	1
Manager (2)	85339	0.003	0.06	0	1
Manager (1)	85339	0.0007	0.03	0	1
Educational Background					
1st Tier National Univ.	85339	0.06	0.24	0	1
2nd Tier National Univ.	85339	0.08	0.28	0	1
3rd Tier National Univ.	85339	0.36	0.48	0	1
1st Tier Private Univ.	85339	0.05	0.21	0	1
2nd Tier Private Univ.	85339	0.10	0.30	0	1
3rd Tier Private Univ.	85339	0.35	0.13	0	1
Cumulative Evaluation					
A	85339	0.01	0.12	0	1
B	85339	0.20	0.40	0	1
C	85339	0.75	0.43	0	1
D/E	85339	0.04	0.19	0	1

Source: Personnel records provided by Company A.

Note: 1st tier national includes Tokyo, Kyoto, TIT, Hitotsubashi and Osaka. 2nd tier national includes Hokkaido, Tohoku, Nagoya, Kyushu, Tsukuba and Kobe. 3rd tier national includes all other national universities. 1st tier private includes Keio, Waseda and Sophia. 2nd tier private includes Meiji, Aoyama, St. Paul's, Chuo, Hosei, Kwanseigakuin, Kansai, Doshisha, Ritsumei, Gakushuin, Nanzan. 3rd tier private include others.

Table 2 Descriptive Statistics of **Company B, College Graduate White Collar, 1991-2010, Wages Only Available 2005 and After**

Variable(Company B)	N	Mean	Std. Dev.	Min	Max
Cohort Size	81952	144.38	86.85	47	309
Female	81952	0.12	0.32	0	1
Tenure	81952	7.60	5.93	0	19
Monthly Wage	81952	365962	150537	1090	3600000
Annual Bonus	6114	1607268	881173	30000	4624000
Job Grade Level					
Rank 1 (J1)	81952	0.06	0.24	0	1
Rank 2 (J2)	81952	0.11	0.31	0	1
Rank 3 (SA)	81952	0.13	0.33	0	1
Rank 4 (SB)	81952	0.19	0.39	0	1
Rank 5 (G6)	81952	0.18	0.37	0	1
Rank 6 (G5)	81952	0.24	0.43	0	1
Rank 7 (G4)	81952	0.10	0.30	0	1
Rank 8 (G3)	81952	0.01	0.09	0	1
Educational Background					
1st Tier National Univ.	81952	0.24	0.42	0	1
2nd Tier National Univ.	81952	0.16	0.36	0	1
3rd Tier National Univ.	81952	0.26	0.43	0	1
1st Tier Private Univ.	81952	0.11	0.32	0	1
2nd Tier Private Univ.	81952	0.08	0.28	0	1
3rd Tier Private Univ.	81952	0.15	0.35	0	1
Cumulative Evaluation					
S	81952	0.06	0.27	0	1
A1	81952	0.17	0.36	0	1
A2	81952	0.68	0.47	0	1
A3/B/Z	81952	0.09	0.29	0	1

Source: Personnel records provided by Company B.

Note: the same note applies as Table 1.

Table 3 Effect of Cohort Size on Quit, College Graduate White Collar 1991-2010 (Company A)

Dep. Var.	Cohort Size （10 persons）	Female	Tenure	Tenure2 /100	Psuedo R2	N
Separation	0.11	.374	.056	-.213	0.17	10238
	(1.26)	(0.017)	(0.003)	(0.016)		

Source: Personnel records provided by Company A.

Table 4 Effect of Cohort Size on Quit, College Graduate White Collar 1994-2010 (Company B)

Dep. Var.	Cohort Size (10 persons)	Female	Tenure	Tenure2 /100	Psuedo R2	N
Separation	-.001	.062	.015	-.085	0.08	10384
	(0.003)	(0.009)	(0.002)	(0.011)		

Source: Personnel records provided by Company B.

Note: Separation data on Company B are not available prior to 1994.

Table 5 Effect of Cohort Size on Promotion, College Graduate White Collar 1991-2010, Odered Probit Model, School Dummy Variables Controlled (Company A)

Company A		Marginal Effects		
	Coefficients	1st Class	2nd Class	3rd Class
Cohort Size (10 persons)	-0.0342	0.0025	0.0061	-0.0081
	(0.0033	(0.0031	(0.001)	(0.0009)
Female	-0.5110	0.0611	0.0349	-0.0967
	(0.0432	(0.0072)	(0.0028)	(0.0063)
Tenure	1.0728	-0.0855	-0.1761	0.2582
	(0.0081	(0.0027)	(0.0043)	(0.0042)
$Tenure^2/100$	-2.7710	0.2190	0.4543	-0.6713
	(0.0392)	(0.0058)	(0.0111)	(0.0108)
Psuedo R^2	0.59			
N	85339			

Source: Personnel records provided by Company A.

Notes: Panel clustering robust standard errors are reported in parenthesis. All specifications include year dummy variables. Marginal effects for vice supervisor and above positions are not reported because these are very small and imprecisely calculated.

Table 6 Effect of Cohort Size on Promotion, College Graduate White Collar 1991-2010, Ordered Probit Model, School Dummy Variables Controlled (Company B)

Company B		Marginal Effects							
	Coefficients	1st Class	2nd Class	3rd Class	4 Class	5 Class	6 Class	7 Class	8 Class
Cohort Size	-0.0019	0.0000	0.0001	0.0003	0.0003	-0.0002	-0.0005	-0.0001	-0.0000
(10 persons)	(0.0008)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0000)	(0.0000)
Female	-0.8180	0.0236	0.0962	0.1289	0.0567	-0.1347	-0.1547	-0.0159	-0.0002
	(0.0118)	(0.0008)	(0.0021)	(0.0021)	(0.0014)	(0.0025)	(0.0019)	(0.0003)	(0.0000)
Tenure	0.3466	-0.0041	-0.0260	-0.0513	-0.0569	0.0405	-0.1723	0.0121	0.0002
	(0.0033)	(0.0001)	(0.0004)	(0.0007)	(0.0008)	(0.0029)	(0.0052)	(0.0002)	(0.0000)
$Tenure^2/100$	-0.6998	0.0082	0.0524	0.1035	0.1148	-0.0818	-0.1723	-0.0245	-0.0005
	(0.0215)	(0.0003)	(0.0018)	(0.0034)	(0.0037)	(0.0029)	(0.0052)	(0.0009)	(0.000)
Psuedo R^2	0.27								
N	81952								

Source: Personnel records provided by Company B.

Notes: Panel clustering robust standard errors are reported in parenthesis. All specifications include year dummy variables.

Table 7 Effect of Cohort Size on ln(Monthly Wage), College Graduate White Collar 2005-2010 (Company A)

Company A	(1)	(2)	(3)	(4)
Cohort Size (10 persons)	-0.0018	-0.0012	-0.0004	-0.0006
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Female	-0.0697	-0.0617	-0.0341	-0.0233
	(0.0009)	(0.0009)	(0.0006)	(0.0006)
Tenure	0.0426	0.0422	0.0146	0.0151
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$Tenure^2$ /100	-0.0535	-0.0478	-0.0993	-0.0103
	(0.0011)	(0.0011)	(0.0009)	(0.0009)
School Dummy	No	Yes	Yes	Yes
Job Grade Dummy	No	No	Yes	Yes
Job Grade*Evaluation	No	No	No	Yes
R^2	0.89	0.90	0.96	0.96
N	85339	85339	85339	85339

Source: Personnel records provided by Company A.

Notes: Panel clustering robust standard errors are reported in parenthesis. All specifications include year dummy variables.

Table 8 Effect of Cohort Size on ln(Monthly Wage), College Graduate White Collar 2005-2010 (Company B)

Company B	(1)	(2)	(3)	(4)
Cohort Size (10 persons)	-0.0003	-0.0001	0.0006	0.0005
	(0.0002)	(0.0002)	(0.0002)	(0.00002)
Female	-0.1691	-0.1531	-0.0324	-0.0323
	(0.0028)	(0.0029)	(0.0024)	(0.0024)
Tenure	0.0466	0.0467	-0.0052	-0.0053
	(0.0007)	(0.0007)	(0.0001)	(0.0001)
$Tenure^2/100$	-0.0328	-0.0336	0.0681	0.0680
	(0.0050)	(0.0050)	(0.0046)	(0.0046)
School Dummy	No	Yes	Yes	Yes
Job Grade Dummy	No	No	Yes	Yes
Job Grade*Evaluation	No	No	No	Yes
R^2	0.49	0.50	0.50	0.51
N	81952	81952	81952	81952

Source: Personnel records provided by Company B.

Notes: Panel clustering robust standard errors are reported in parenthesis. All specifications include year dummy variables.

Table 9 Effect of Cohort Size on log (Annual Bonus), College Graduate White Collar 2004-2010 (Company A)

Company A	(1)	(2)	(3)	(4)
Cohort Size (10 persons)	-0.0035	-0.0029	0.0001	0.0001
	(0.0009)	(0.0009)	(0.0001)	(0.0001)
Female	-0.1471	-0.1363	-0.1404	-0.0910
	(0.0102)	(0.0101)	(0.0097)	(0.0098)
Tenure	0.1193	0.1194	0.1413	0.1368
	(0.0019)	(0.0020)	(0.0029)	(0.0030)
$Tenure^2/100$	-0.4077	-0.4046	-0.5879	-0.5569
	(0.0167)	(0.0121)	(0.0150)	(0.0151)
School Dummy	No	Yes	Yes	Yes
Job Grade Dummy	No	No	Yes	Yes
Job Grade and Evaluation Dummy	No	No	No	Yes
R^2	0.77	0.78	0.79	0.80
N	4,620	4,620	4,620	4,620

Source: Personnel records provided by Company A

Note: Specification includes year dummy variable and Educational background dummy variables. In the specification with rank and evaluation, the interaction of Evaluation Dummy (A, B, C and D) ×Ability-based rank dummy variables are all included.

Table 10 Effect of Cohort Size on log (Annual Bonus), College Graduate White Collar 2005-2010 (Company B)

Company B	(1)	(2)	(3)	(4)
Cohort Size (10 persons)	-0.0020	-0.0013	-00004	-0.0003
	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Female	-0.1583	-0.1336	-0.0422	0.0017
	(0.0029)	(0.0029)	(0.0061)	(0.0019)
Tenure	0.1176	0.1174	0.0372	0.0341
	(0.0008)	(0.0008)	(0.0006)	(0.0006)
$Tenure^2$ /100	-0.3357	-0.3376	-0.1196	-0.1043
	(0.0056)	(0.055)	(0.0039)	(0.0039)
School Dummy	No	Yes	Yes	Yes
Job Grade Dummy	No	No	Yes	Yes
Job Grade and Evaluation Dummy	No	No	No	Yes
R^2	0.70	0.71	0.83	0.88
N	6,114	6,114	6,114	6,114

Source: Personnel records provided by Company B.

Note: Specification includes year dummy variable and Educational background dummy variables. In the specification with rank and evaluation, the interaction of Evaluation Dummy (S,A1,A2 and A3/B/Z) Ability-based rank dummy variables are all included.

Figure 1 Size of entry cohort of Company A, college-graduate white collar

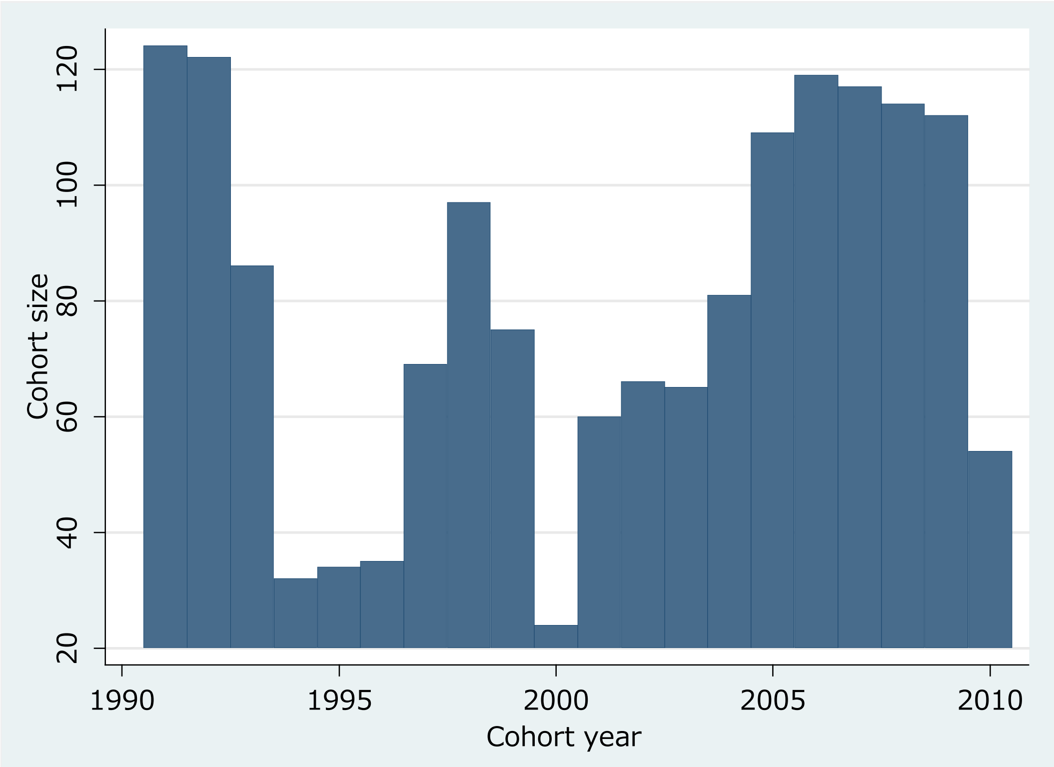

Figure 2 Size of entry cohort of Company B, college-graduate white collar