Dynamics of the Gender Gap in the Workplace: An econometric case study of a large Japanese firm

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Abstract

Taking advantage of unusual access to confidential personnel records from a large chemical manufacturing firm in Japan, this paper provides novel evidence on the nature and causes of gender pay gap. Specifically we find that controlling for job levels and skill grades will result in the estimated gender pay gap in total pay reduced by 6-to-8-percentage-point, implying that slow promotion of women explains almost half of the observed pay gap. In contrast, controlling for subjective evaluation is found to lead to no discernible reduction in the estimated gender pay gap. To explore the mediating role of job levels in the gender pay gap further, we estimate probit models of promotion rates and confirm significant gender gap in the odds of promotion to higher job levels. The probit estimates also yield evidence on the nature of gender gap in career development, i.e., (i) there is a statistically and economically significant correlation between working hours and promotion rates for women but not for men; (ii) in general maternity carries a substantial career penalty, especially for college graduate women (up to a 25-30 percentage-point fall in the future earnings as a result of maternity); but (iii) the maternity penalty can be offset by returning from parental leave promptly. As such, our evidence points to the importance of women's ability (or lack thereof) to signal their commitment to work (and the level of family support they receive) through working long hours and taking less frequent and shorter parental leave for their career advancement.

JEL codes: J16, J31, M51

1. Introduction

The gender pay gap is a persistent nature of every country's labor market (Blau 2003) and it is especially large and tenacious in the Japanese labor market. Although the gap narrowed significantly over the past few decades in Japan as in other OECD countries, the government statistics still shows sizable gap (see figure 1). Furthermore, as Abe (2010) shows, much of the past decline in the gender pay gap seems to be caused by an increasing female enrollment in college and a rise in the recruitment of college-educated women by large firms after the enactment of Equal Employment Opportunity Act (EEOA) in 1986. How much of the pay difference still remains between male and female workers with similar educational background and experience, and especially whether those college-educated women are treated fairly equally with their male peers still remain unanswered. Although many prior works have emphasized sorting as an important source of the gender pay gap—women are more likely to work in low-wage industries (Blau and Kahn 2003) or work as non-standard (or non-regular) workers (Houseman and Osawa 2003), this study focuses on intra-firm differences in pay between men and women. This approach is reasonable especially when we are interested in the effectiveness of the firm's practices that are meant to insure a level playing field for women and facilitate their return to work after childbirths.

After the passages of the 1992 Child Care Leave Act, the 1999 Child Care and Family Care Leave Act and its amendment in 2005 (CCLA hereafter for all), many large Japanese

firms introduced policies of longer parental leave (up to 3 years in some firms) and reduced working hours (until the child enters an elementary school in some firms) as options for working mothers. The impact of the provision of such longer parental leave on the gender wage gap is theoretically ambiguous. On the one hand, such policy will encourage women to stay employed in the same firm and their lifetime earnings should be greater than those who quit job to stay home while raising their children. Furthermore, the firms may provide women with more training knowing that a greater portion of female workers than before will remain on job after childbirth (women also increase their investment). On the other hand, the wage penalty for women who take longer parental leave may be substantially large. Women who otherwise take short parental leave may be encouraged to take longer leave by the new policy and miss the opportunity of promotion and training, thus ending up having less important responsibilities with lower pay.

According to the National Fertility Survey conducted by National Institute of Population and Social Security Research every five years, however, the share of women who quit jobs at the birth of their first child has changed little hovering around 60-64% for the past 25 years implying that the CCLA did not encourage women to stay on the job after the first childbirth. Therefore, the above positive impact presumably did not materialize.

One important feature of post- CCLA work environment for women is that they have more choices about how long leave they take for parenting and how many hours they work

while their children are small. It is plausible that this creates a signaling opportunity for women to show their commitment to work. Suppose the propensity to quit or remain on the job is a private information of the worker herself. Since women are much more likely to quit than men at major life events such as marriage and childbirth, the employers may not want to train or assign important tasks to women. This is statistical discrimination. However, the employer will be willing to invest more in a woman if she can credibly demonstrate her commitment to work. Such signaling may take the form of working long hours, staying unmarried for many years, or returning to work after childbirth within a short period of time.

In addition to the statistical discrimination hypothesis, we explore for the possibility that women are passed over for promotion simply because they are too time-constrained by their expected role in providing housework and childcare to take jobs with important responsibilities.

In this study, we first scrutinize how much gender pay gap still exists within organization after accounting for a number of human capital variables and other worker characteristics using detailed personnel records from a large Japanese chemical manufacturing firm. Then, we examine what factors are associated with the gender gap in pay and promotion speed to look for the evidence of maternity penalty, time constraint women face due to their expected role in providing housework, and statistical discrimination.

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2. Prior Literature (***Incomplete*!**)

There is some limited work about the gender pay gap in Japan. Abe (2010a) finds that a substantial portion of the gender wage convergence is due to changes in the educational composition of the workforce and that the convergence is much smaller when the gap is calculated for each level of education.

3. Data

We collected personnel records from a Japanese chemical manufacturing company which has about 7,000-8,000 regular employees within Japan and, including affiliated firms, well over 20,000 employees worldwide. It is one of the first few firms which participated in our industry-academics-government collaboration to create a personnel data depository. Our partner, Works Applications, Co. is a major ERP software package provider in Japan who has about 300 listed firms in their user network. The Research Institute of Economy, Trade and Industry (RIETI), a think tank established by the Ministry of Economy, Trade, and Industry for policy-oriented research also helps our research by providing technical resources to store the date in a highly secured environment. In this project, almost all personnel records stored in the firm's human resource management system are obtained except for sensitive identity information such as names and addresses, saved in the RIETI's high-security server, and then studied remotely by researchers through the RIETI's virtual private network (VPN).

The dataset consists of five major components: (1) employee characteristics, (2) pay and benefits records, (3) working hours and absentee records, (4) evaluation records, and (5) announcement records for entry, separation, leave, transfers, and job re-assignment. It covers all domestic workers who ever worked for the firm's domestic establishments between FY2004 and FY2009.

Important employee characteristics available in the dataset include gender, birthday, date of entry, nationality, education history, and marital status. Since the dataset includes all post-compulsory education for most employees, we have detailed information of education backgrounds. The education level is constructed as a time-varying variable because some employees went to part-time college or vocational school programs and earned degrees after the entry. Marital status is also constructed as time-varying because the personnel records include the date of wedding or divorce. Although we do not have the information for the number of children, we have the number of dependents. The number of dependents directly affects the earnings because the firm pays dependent allowance. For married male employees, the number of dependents typically equals the number of minor and non-employed children plus one if the spouse is not employed. For married female workers, the number is usually zero if the spouse is employed and their children are reported as dependent at the spouse's employer. Therefore, it should be noted that the number of dependents could be the primary source of asymmetric impact of marriage on the pay of men and women.

Although the pay information is available from FY2004, part of our analyses needs to be restricted to the period between FY2005 and FY2009 because working hour information is available only after FY2004 and we use hourly wage as one of the measures of earnings. It is important to compare hourly wage because female workers work less than male workers especially after marriage and even so after bearing children.

The evaluation records are available between FY2003 and FY2009. Employee performance is evaluated annually using the seven-point scale (SS, S, A1, A2, A3, B, C) until FY2007 and the five-point scale (SS, S, A, B, C) after FY2007. The company does not use the method of forced distribution, namely it does not require the managers to distribute the evaluation grades to a certain pre-specified grade allocation. As a result, there is a strong centrality tendency—about 80 percent of employees receive the A grade (A1-A3 grades before the policy change) every year.

One big advantage of the dataset is that the job assignment history data covers the entire employment period starting in the month of entry, which enables us to compute the intra-firm mobility (e.g. the number of transfers/job rotations experienced), the scope of skills (e.g. the number of tasks/functions assigned to the employees), the length of parental leave taken (e.g. the loss/depreciation of human capital during the period of parenting), although we have not fully exploited this advantage in this study.

1 Descriptive Statistics

We first describe the employee composition by gender and marital status. Although we do not have the information about the number of children as we stated earlier, we have the precise records of parental leaves since FY1999. Since pregnant women are entitled to maternity leave of fourteen weeks (eight weeks immediately after the delivery is mandatory), we can utilize the incidence of maternity leave as the indicator of small children. Table 1 shows the composition of single/married men and women, and the group of married women who took at least one parental leave since FY1999.[1]

As Table 1 shows, the share of female employees hovered around 11% during the observation period, which is lower than the average of large manufacturing firms with 1000 employees or more that was 16-18% during the same period according to Basic Survey on Wage Structure from the Ministry of Health, Labour and Welfare.

Table 2 displays most primitive exposition of gender pay gap. Compared with married men, single men, single women, married women without small children, and married women with small children earn 28%, 36%, 32%, and 43% less, respectively. Since married men are 5-10 years old than the other groups on average, substantial portions of the gaps should come

[1] Calling this group “Married Women with Small Children,” however, is not precise for three reasons. First, the definition of small children varies across years as it includes increasingly older children in later years. Second, women with small children who were recently hired and thus did not take parental leave at the company are not included, if any. Third, we include single mothers in this group because they will suffer at least the same level of motherhood and immobility penalty as married women with small children.

from differences in human capital. Furthermore, women, especially those who are married and have small children work substantially less than men. Single women, married women without small children, and married women with small children work 7%, 12%, and 22% less, respectively, than married men while single men do not work significantly differently than married ones. Since we excluded records in the years when employees took at least one month of leave from our analysis, low numbers for women with small children are not the result of parental leaves. One relevant company policy that contributed to the difference is that women with children less than three years old can reduce the working hours up to 6 hours per day. The provision of such policy or equivalent substitute is required by the 2002 amendment of Child Care and Family Care Leave Act enacted in 1992

When compared using hourly wage, single men, single women, married women without small children, and married women with small children earn 29%, 29%, 23%, 27% less, respectively than married men.

In addition to differences in experience, those in the education level should have contributed to the gender pay gap. Table 3 shows the changes in the distribution of education levels by gender over the past two decades. Surprisingly, due to a drastic shift in its hiring policy in the 90s, the gender gap in educational background narrowed substantially since then. In the 1990s, the share of college graduates including those with graduate degrees was 43% for men and 18% for women. In the 2000s, this gender gap reversed with the share being

52% for men and 59% for women. As the firms slashed administrative assistant jobs, it stopped hiring women with 2-year college degrees and high school degrees. Instead, it recruited more women with 4-year college degrees and master degrees and more from vocational schools. The chemical company also beefed up its hiring of medical technicians from medical vocational schools as it expands its line of healthcare products. Almost all men with high school degrees are hired as production workers and they are not expected to decline in number as drastically as women with similar degrees unless the company decides to shut down many of its domestic plants.

As we will show later, the gender pay difference is smaller among younger workers mostly due to decreasing inequality in education level between men and women. This result is consistent with Abe (2010a), which find that a substantial portion of the gender wage convergence is due to changes in the educational composition of the workforce and that the convergence is much smaller when the gap is calculated for each level of education.

Higher education level of women should naturally lead to an increase of women in upper-level jobs in the hierarchy. The chemical manufacturing company we study has a job grade system where each job is assigned a job grade based on the job content value evaluated. Each job grade corresponds to a particular pay range according to which the total monthly salary is set for managers and half of the monthly salary is specified for non-managerial jobs. Therefore, moving up to a higher level grade is associated with a pay raise and announced as

a promotion. Figure 2 illustrates the promotion ladders observed in the company. Solid lines indicate typical paths for those who get promoted and dotted lines represent atypical but not so rare cases of promotion. College graduates on the management track are first assigned to J1 but quickly move up to J2. Almost all members of this group move to SA and SB, and its majority eventually move to the management ranks of G6 and up. Production workers start at the same level J1 but more slowly climb to J2 and J3. Some highly talented blue-collar workers may be considered for managerial positions and they will be typically assigned to J4. Some of them may move up to the management track (e.g. SA, SB or G6) or get promoted to GH, which is the level of foremen. Administrative support staff members who typically have high-school or two-year college degrees can move up to J2 and J3 levels but it is extremely rare for them to get promoted to managerial positions.

Table 4 shows the distribution of workforce across job grade levels, gender and marital status in FY2004 and FY2009. Since our dataset does not include the employees who left the firm before FY2004, the precise employee composition can only be calculated for the period between FY2004 and FY2009. Although a higher percentage of women are observed in higher level positions in FY2009 than in FY2004, there are still too fee women in upper-level positions. For example, even as of FY2009, only 3.4% of management-track positions are

filled by women.[2] Among senior managers, only 19 (1.6%) are women. None of those with small children are in the management track. Given that the 11% of its workforce are women, this share of women in the managerial positions is significantly low.

This low presence of women in upper levels in the hierarchy should be brought by either slow promotion or high turnovers among women, or both. In order to investigate these possibilities, we first examine how the promotion rates differ between men and women. Table 6 shows the frequency of promotions by gender and marital status. We compress the original job grades between J1 and G3 (11 grades) to 8 levels in order to study white-collar track and blue-collar track on a comparable scale. In this table, promotions from J2 to J3 for production workers and administrative assistant are not counted as promotion because these two job grades are combined as one job level in our analysis. High promotion rates at the entry level J1 are not surprising because the company has a policy of assigning new college graduates to J1 and quickly move them all up to J2 after one year. Low promotion rates from the J2/J3 level to the SA/J4 level are not surprising because many production workers and administrative support staff members with high school and 2-year college degrees are stuck in the J2/J3 level with no more promotions. Although talented production workers still have a

[2] Here, we define management-track as exempt employees who are not union members. Although they are called "*kanri shoku* (managers)", many of them actually do not have subordinates in the formal sense. On the other hand, we define senior managers as managers who have the responsibilities to develop and evaluate subordinates' skills. They have no association with actual titles they have in the firm.

prospect of getting promoted to foremen or plant management positions, such career track is very limited for female administrative assistants, who, as a result, show very low promotion rate at this level.

Although women have a higher promotion rate at the SA/J4 level than men, this advantage disappear once women reach the SB/JH and continue to lag behind men. For example, although 17% of men with G5 grade get promoted to G4 every year on average, only 8% of women with the same grade get promoted in a similar manner. Since three quarters of women with G5 grade are married, this slow promotion of women may be associated with constraint on working hours or lack of geographic mobility.

We next examine how separation rates differ between men and women over the life cycle. Figure 3 illustrates yearly separation rate separately by gender and marital status. Here, we define separation as the sum of voluntary quits and dismissals and do not include mandatory retirement, permanent transfer to affiliated firms, or death. As the figure shows, women, both single and married, face much higher hazard of separation than men throughout the life cycle. Women seem to consider quitting as an important option at major personal events such as marriage and childbearing.

2 Empirical Strategy

Our empirical analysis presented later will reveal that women are slow in getting promoted. Part of the reason is that employees are segregated by gender among jobs. Production workers are predominantly men while administrative assistants are predominantly women. Since there is very limited chance of promotion for administrative assistants whereas production workers have substantial opportunities to get promoted to foremen and plant managers, the difference in promotion opportunities between occupations may be causing this gender gap. Slow promotion for female workers, however, is also prominent even among college graduates who are more homogeneous group.

There are two plausible explanations that are related but have slightly different empirical implications.

First, female workers may get promoted less frequently simply because they have more stringent time constraint due to their expected role in providing housework and childcare. According to the 2006 *Survey on Time use and Leisure Activities* in Japan, married men with children provide only 10% of housework and childcare, which is much lower than the comparable figures of 30-40 % in other developed countries. If this reflects the social norm governing the behaviors of many couples, married women, especially those with small children should choose to work shorter hours than their male peers. If leading a team or performing important responsibilities requires being flexible in working hours to respond to emergencies and solving problems in a timely manner, those who cannot work beyond

regular work hours will not be entrusted with such responsibilities. Such competing demands of “work in marriage” are especially intense when women have small children. As we mention earlier, according to the National Fertility Survey conducted by National Institute of Population and Social Security Research, the 60-64% of women quit jobs at the birth of their first child and those who stay work significantly less hours than before. Women are expected to be penalized for less working hours and commitment. Additionally, married women with children suffer from the loss of human capital during the interruption caused by the childbirth. Their general and firm-specific human capital will both become obsolete during the absence. Since the empirical implication for the loss of human capital is the same as the one implied by the time constraint explanation, we will not distinguish the two.

Second, statistical discrimination may further affect those women who do not yet face competing demands of work in marriage. Since women are more likely to quit at major life events such as marriage and childbirth, the expected return to training is lower for women. Low on-the-job training could take the form of assigning less important tasks to women. If this happens, female workers will accumulate less human capital and thus less prepared to take more responsibilities. Another implication of statistical discrimination is that signaling opportunities may be more valuable for women. Women who plan to stay on the current job may signal their commitment by working long hours, staying unmarried, and (if married) taking shorter parental leave at childbirth.

Although these two explanations are not mutually exclusive or collectively exhaustive as reasons for the gender differences, they have testable implications. First, competing demands explanation implies that the negative association between femaleness and pay and promotion should be substantially reduced once parental leave history and working hours are accounted for. Second, statistical discrimination explanation implies that women who work equally hard as their male colleagues may still be given less training and less career opportunities because their expected probability of leaving the firm or showing less commitment in the future is higher. This implies that, due to the asymmetric information regarding the future possibilities, signaling may work more effectively for women—promotion decision may be more correlated with observable effort measures such as working hours. Women may also not be penalized (or even rewarded) for bearing a child if they take a short parental leave to express their commitment to work. Thirdly, the effect of competing demands and statistical discrimination will appear more strongly for those on the management track because required human capital investment and worker commitment are higher. That means that the association of working hours and parental leave history with worker pay and promotion probability should be more significant for college graduates than those with lower education.

In the section that follows, we first investigate how large is the gender pay gap, we estimate the following Mincerian wage function:

$$\ln wage_{it} = X_{it}\beta + \gamma^1 Marriage_{it} + \gamma^2 Female_i + \gamma^3 Marriage_{it} \times Female_i + c_i + u_{it} \quad (1)$$ where the dependent variable $\ln wage_{it}$ is the logarithm of either total pay or hourly wage for worker *i* in fiscal year *t*. Total pay is the sum of taxable salary and bonus whereas hourly wage is calculated by dividing only taxable salary by working hours.[3] *Marriage* and *Female* are the indicators of being married and female, respectively, and X_{it} is the vector of other worker characteristics including age, tenure, and education level. Since workers do not accumulate firm-specific human capital during leave, our firm-specific experience variable *tenure* is adjusted for the length of parental and family leave. c_i is the worker random effect with $E(c_i \mid X_i, Marriage_i, Female_i) = 0$, and u_{it} is i.i.d. with $E(u_{it} \mid c_i, X_i, Marriage_i, Female_i) = 0$.

In estimating the gender differences in promotion, we estimate either ordered logit model or probit model with the following specifications:

$$Y_{it}^* = X_{it}\beta + \gamma^1 Marriage_{it} + \gamma^2 Female_i + \gamma^3 Marriage_{it} \times Female_i + u_{it} \quad (2)$$

where Y_{it}^* is the latent variable for either job grade (ordered logit model) or the incidence of promotion (probit) for worker *i* in year *t*. u_{it} is the error term and follows logistic distribution conditional on $(X_{it}, Marriage_i, Female_i)$ and may be correlated within *i*. Thus, we use clustered standard errors to evaluate the significance of coefficients.

[3] Since bonus does not directly depend on working hours, including bonus in the calculation of hourly wage overstate the earnings of those with shorter working hours. It is also worth noting that using the hourly wage measure may be misleading for managers, sales staff, and researchers who do not receive overtime pay. For these professional employees, working hours are recorded for the health management purpose.

One important caveat is that the coefficients β, γ^1, γ^2, and γ^3 in equations (1) and (2) could be biased if selection (i.e. entry and attrition) is not exogenous conditional on $(X_{it}, Marriage_i, Female_i)$. For example, capable female workers with greater promotion prospect may be more likely to stay after marriage and childbirth. When it is necessary to correct for such a selection bias, we either estimate a fixed effect model or test exogeneity.

3 Results

3.1 Gender gap in pay

Table 7 shows the results of the estimation of equation (1) using the entire sample. The baseline model in the first column is the most parsimonious specification controlling only for age and tenure. As you might expect, the gender pay gap is the largest with this model and indicates that single women earns 22% less than single men on average. Men enjoy a significant marriage bonus—6% more than single men—but, women experience a marriage penalty of 2%. As such, gender pay gap is found to widen as workers are married, resulting in the gender pay gap of 30 percent in nominal wage earnings.

Adding education levels as control reduces the gender pay gap only slightly (to 19% for the unmarried and 28% for the married) because women in this firm had as much education as men did in recent years (see the second column). A notable difference can be found between the employees who graduated from colleges of technology and those from two-year

colleges. The former are public colleges that provide five-year education in engineering for those who finish the lower secondary school (middle school). Although graduates of colleges of technology have two year less education than those from four-year colleges, they are treated almost equally as college graduates in terms of career path. Most of them advance to SA and SB, management trainee positions. In contrast, two-year colleges provide liberal art education to mostly women. Graduates from those junior colleges become administrative support staff members and typically follow the same career path as female high school graduates and rarely go beyond the J2 level. Only a few percent of them can switch to the management trainee positions (e.g. SA and SB job grades). Including education level variable as control allows us to account for the above different career implications of the two groups with seemingly similar length of education.

One important fact that we should keep in mind is that the company has changed job design and pay systems a number of times since the Equal Employment Opportunity Act (EEOA) became first effective in FY1987 with the last major reform implemented in FY2003. It was in this FY2003 reform when the current job grade system was introduced. Assuming that the old system was more discriminatory against women and the switch to the new job grade system did not adjust the pay levels automatically for those old employees who entered the firm many years ago, the pay differences between male and females workers should be greater for older cohorts. In order to examine this prediction, we restrict our analysis to those

who graduated in FY1987 and after in the third column. As we have expected, the estimated gender pay gap is 4-4.5 percentage point smaller for both the unmarried and the married.

Although the 15-28% pay differences even after accounting for education levels may sound discriminatory, a substantial part of it might be due to the choice made by the employees themselves. Since married women, especially those with small children typically prefer shorter working hours and the company specifically offers the option of shorter working hours for working mothers, comparing nominal total pay to study the gender pay gap is misleading. The column 4-6 in table 7 repeats the same regression analysis as above using hourly wage as dependent variable. Now, the gender pay gap after controlling for education levels is 12% for the unmarried and 17% for the married, much smaller than for the total pay (see column 5). The gap is further down to 9% and 15%, respectively, when the analysis is restricted to the younger cohorts in FY1987 and after.

If the new policies and practices that the company introduced in the past decades have limited or gradual impacts on the pay for older cohorts, the gender pay gap will show a downward trend as the improvement continues at the individual level or more in the older cohorts leave the firm. Table 8 shows the gender pay gap for the unmarried and the married and marriage premium for men for each year in our observation period. They are based on the coefficients in the random effect model estimation repeatedly run for each year. Although there actually is a downward trend in the gender pay gap for both unmarried and married

groups, the declining trend seems to have stopped in FY2009. It may be related to the company's reaction to the financial market meltdown in 2008.

In order to further investigate what factors are causing such a substantial gender pay gap, we repeated the same regression analysis adding one additional control variable in each step. Table 9 shows the results. Model 1 for total pay and hourly wage correspond to column (1) and (4) in Table 7, respectively—accounting for only age (fourth degree polynomial), tenure (quadratic), and fiscal year dummies. Model 2 additionally control for education thus corresponds to column (2) and (5) in Table 7.

Model 3 further controls for the number of dependents (in the logarithm) to capture the difference created by the allowance for dependents. This benefit that favors workers with family is reminiscent of the practices promoted by the government during the war time and still prevalent among large Japanese firms. As we have discussed earlier, the existence of dependent allowance directly increases both marriage premium for men and the gender pay gap for the married because most married couple claim their dependent(s) in the tax filing documents for the husband.[4] After accounting for the number of dependents, the reduction in the marriage premium for men or the gender pay gap for the married is 0.4-0.8% for the total pay but 2-3% for hourly wage. The discrepancy presumably comes from the offsetting effect

[4] Generally speaking, it is more beneficial to claim a dependent for tax exemption for whichever earns more. We believe that husbands typically claim it either because they earn more or because it is shameful to admit that their wives earn more. The payment of dependent allowance has to be based on the information on the tax documents.

through working hours. Since workers with more children work less hours, the impact of the number of dependents on total pay underestimate the true impact of dependent allowance. The result using hourly wage will give us less biased estimate of the impact.

Model 4 additionally controls for job grades and job skill rank. Job grades are determined based on the actual job assigned to the worker whereas job skill rank is determined based on the supervisors' evaluation of the worker's skill level, which is part of the annual evaluation. For non-managers, half of the base salary is determined by their job skill ranks. Since job grades and job skill ranks are two of the most important determinants of salary and bonus, adding the two has improved R squared substantially and reduced the gender pay gap substantially—by 7-8% for total pay and 4-5% for hourly wage. This means that a substantial part of the gender pay gap is caused by slow promotion for females workers. However, surprisingly large gender gap still remains—11% for the unmarried and 20% for the married when total pay is used to measure earnings and 7% for the unmarried and 10% for the married when hourly wage is employed. Further accounting for evaluation results (Model 5) and establishment (workplace location) dummies (Model 6) does not seem to reduce the gap.

There is one potential reason behind this puzzle. Note that not all jobs in the same job grade are similar. For example, both production workers and administrative support staff move up the blue-collar track (i.e. J1-JH). Even when they are assigned to the same job grade,

monthly salary could be significantly different between production workers and administrative assistants due to differences in benefits and premium pay for off-hour shifts for production workers (i.e., night-time and holiday shift). Note than the gender composition is strikingly different between production workers and administrative support staff as the former is predominated by men and the latter by women.

In order to avoid the bias caused by pay differences among occupations, we next restrict our analysis to only college graduates who are more homogenous in quality and the job they do. Almost all college graduate new hires become white-collar professionals who will be promoted eventually to the management ranks (e.g. G6-G1) if they perform well. Table 10 shows the result for this subsample. In order to account for the worker quality, we include the university ranking information in Model 2.[5] The results in the table show a very similar pattern to Table 9. Even in this subsample, the gender pay gap is still large before working hours, job grades and job skill ranks are accounted for. Single women earn 12% less than single men with the same experience according to Model 1. Since marriage bonus which is 7% for men cannot be found in the pay for female workers, married women earn 20% less than married men with the same experience. When hourly wage is used as the earnings

[5] University ranking is a category variable where 1 indicates the 1st-tier national universities (Tokyo, Kyoto, Hitotsubashi, Osaka, Tokyo Institute of Technology, Tokyo University of Foreign Studies), 2 indicates the 2nd-tier national universities (Nagoya, Kobe, Tsukuba, Kyushu, Hokkaido, Tohoku, Ochanomizu, Yokohama National), 3 indicates the 1st-tier private universities (Keio, Waseda, Sophia, ICU), 4 indicates the 2nd-tier private universities (Gakushuin, Meiji, Aoyama Gakuin, Rikkyo, Chuo, Hosei, Tokyo University of Science, Doshisha, Ritsumeikan, Kansai Gakuin, Kansai, University of Occupational and Environmental Health), and 5 indicates all other universities.

measure, however, the gender pay gap shrinks to only 2% for the unmarried (only weakly significant) and 4% for the married after accounting for university quality, the number of dependents, job grades and job skill ranks. Again, the 5-6 % of the gender pay gap is caused by slow promotion of women.

To sum up, when more homogeneous group of college graduates is studied, a substantial portion of gender pay gap comes from shorter working hours and slow promotion of female workers. The 4-8 percentage point of the gender pay gap is due to the difference in the promotion speed between male and female workers. We next examine potential reasons behind the differences.

3.2 Gender gap in promotion

Table 11 exhibits most primitive analysis of gender gap in promotion using ordered logit model estimation. As is consistent with our results of random effect model estimation of wage function, job grades are persistently negatively correlated with femaleness after accounting for education and experience and the gender gap is greater between married men and women. The results are robust to the inclusion of evaluation grades and establishment location (headquarter or region) and the restriction to college graduates.

One interesting implication in this table is that the average productivity of college graduate women is no less than their male counterparts because the gender gap does not

decline as we account for school ranking and evaluation grade. The gender gap between unmarried men and women rather increases as we account for these variables. The findings may indicate that the observed gender pay gap is caused neither by unobserved productivity differences nor by discrimination in evaluation.

3.3 How large is maternity penalty?

In order to evaluate the magnitude of maternity penalty, we estimated random effect and fixed effect models similar to equation (1) including variables summarizing parental leave history and working hours. *births* is a category variable indicating the number of maternity leave spells that each worker took in the past and can be interpreted as the number of small children. Since there are only a few cases of more than two childbirths, we combine cases of two or more spells as *births* = 2. *leave_pd* is the average length of total leave (maternity leave plus parental leave) per child.[6] *hours* is the annual working hours and its logarithm is normally used as control for wage function estimation.

Table 12 shows the results for all employees and a subsample of women. Compared with the second column of Table 8, the coefficients of *Female* and *Marriage* $\times$ *Female* are smaller

[6] There are two points worth noting about the definition of *leave_pd*. First, as a company policy, men can also take parental leave but maternity leave is only for women. Since *births* is defined as the number of maternity leave spells, *births* = 0 always holds for men even if some took a parental leave in the past. For them, *leave_pd* is the total period of leave they took in the past. Second, the company data does not distinguish parental leave from other family care leave. Although we can distinguish them for women because maternity leave always precedes parental leave for women, we did not do so because cases of other family care leave are limited.

in Column 1 and 2 of Table 12 indicating that some portion of the gender pay gap estimated earlier in fact reflects maternity penalty. Since the coefficient of *births* = 1 is significantly positive, maternity penalty is not linear. However, it does not mean that a female worker with one child receives a higher wage because she typically takes fourteen weeks of maternity leave (eight weeks out of it is mandatory) and additional two to nine months of parental leave. The coefficient results for *births* and *leave_pd* in Column 1-3 seem to indicate that the average mother is subject to maternity penalty but those who return taking only four to six months of leave are not penalized at all thereafter in terms of wage income.

One problem with random effect model estimation is that the results may be biased due to endogenous attrition. For example, capable employees may be more likely to stay at childbirth, which will bias the coefficients of *births* upward. In order to account for such effects of time-invariant unobservable worker characteristics, we estimate fixed effect models and the results are presented in Column 4 and 5. The coefficients are not significantly different from those in Column 1-3 thus implying that female workers who return from maternity/parental leave within a short period of time are not penalized.

Note that the incidence of childbirth and the choice of parental leave periods could affect the wage level through multiple channels. First, having a small child will lead to less working hours due to a competing demand of childcare. Second, the expectation of less working hours and commitment, or revealed commitment through the choice of shorter leave periods may

result in a change in job assignment to the one with less or more responsibility, respectively. The provision of training may also change accordingly. Such changes in human capital investment should affect the chance of promotion in the future. The purpose of including working hours as a control is to distinguish the effect through working hours and that through changes in job assignment and training. Column 5 in Table 12 seems to indicate that a childbirth does not affect the job assignment and the amount of training as long as the length of leave is short enough. One concern in this argument is that the coefficient of working hours and leave variables may be biased due to time-varying unobservable factors that affect both working hours and the wage level. In order to correct for such endogeneity, we estimate the fixed effect 2SLS model. As we explain it in details later in Section 3.4, we used commuters' allowance as an instrument. The result provides even stronger support for the argument that female workers are not penalized in wage income for bearing a child as long as she has only one child and return from leave within a short period of time.

In order to show how large is maternity penalty, we calculated the expected future drop in income for four patterns of parental leave history based on the models (3)-(6) in Table 12 and 13. The results are presented in Table 14. As we discussed earlier, there is a substantial maternity penalty when a female worker takes a long parental leave or the second one.

Table 13 presents the results of the same analyses for a subsample of college graduates. The coefficients clearly indicate that the penalty for longer parental leave (i.e. the coefficient

of *leave_pd*) is much greater for college graduates. For this group, even those who return right after minimum four months of mandatory maternity leave suffer income loss. Interestingly, there is no college graduate woman who has taken maternity leave twice in the dataset. So, there might be a strong belief that it is not a feasible choice for female workers to continue to work on a management-track position while raising two small children. Such strong maternity penalty for college graduate women may mean that: (1) their work is non-routine and requires substantial task-specific human capital making it hard to assign a substitute on the job during the leave (better to replace her); and (2) depreciation of their skills is faster and thus their performance drops after interruptions. The maternity penalty for college graduate women calculated in Table 14 indicates its magnitude.

The result is consistent with Bertrand, Goldin and Katz (2010) who found that the gender pay gap is associated with career interruptions due to parenting. Since their dataset consists of MBAs from a top school, highly educated women, career interruptions may be especially costly.

3.4 How important is long working hours as a determinant of promotion?

In order to further investigate the mechanism behind the slow promotion of female workers, we evaluate the causal impact of working hours on promotion. As a first step, we examine what determines the working hours by estimating the following equation:

$$Hours_{it} = X_{it}\beta + Z_{it}\delta + \varphi^1 Marriage_{it} + \varphi^2 Female_i + \varphi^3 Marriage_{it} \times Female_i + c_i + v_{it} \quad (3)$$

where *Hours* is annual working hours and the right-hand side variables similar to those in Equations (1) except that Z_{it} is a vector of the following two variables and the first variable's interaction with *Female*:

Commuter_Allowance: the ratio of commuter allowance relative to the monthly salary paid to the worker.

Zero_Allowance: indicator of no commuter allowance paid to the worker in the year.

We assume that commuter allowance is roughly proportional to the time required for commuting. If home addresses are pre-determined independent of the factors influencing the worker's performance, this could be used as an instrument to identify the causal impact of working hours on pay (Table 12-13) and promotion (Table 15-16) because the commuting time will determine the marginal cost of work thus affecting the working hours directly. The ratio of commuter allowance to the monthly salary is used because high income could also reduce the marginal opportunity cost of work by enabling the spouse to stop working and stay home or outsource housework (i.e. eating out, hiring housekeeper and babysitter, etc.). The indicator variable *Zero_Allowance* is necessary because receiving no commuter allowance does not necessary mean that the worker lives in the walking distance of the workplace. It may mean that the worker drives, participate in car-pooling, or biking.

Table 15 shows our results confirming three predictions: (1) women work less even after accounting for parental leave history; (2) more children and longer parental leave at childbirth are good predictors of future working hours; (3) commuting distance proxied by commuter allowance significantly affects working hours both men and women. Part of the reason behind shorter working hours of women may be menstrual leave that women are entitled to by Labor Standards Act.

Next, we estimate the following probit model to examine how working hours affect the chance of promotion.

$$\begin{aligned} Prom_{it}^{*} = \tilde{X}_{it}\beta + \lambda^{1} \ln Hours_{it-1} + \lambda^{2} \ln Hours_{it-1} \times Female_{i} + \gamma^{1} Marriage_{it} \\ + \gamma^{2} Female_{i} + \gamma^{3} Marriage_{it} \times Female_{i} + u_{it} \end{aligned} \quad (4)$$

where $Prom_{it}^{*}$ is the latent variable in the Probit model for the binary outcome $Prom_{it}$ which is a dummy variable indicating the promotion to a higher job grade. u_{it} is the error term that may be correlated within *i*. Thus, we use clustered standard errors to evaluate the significance of coefficients. Note that we include the interaction between *Female* and ln*Hours* to account for the possibility that working hours may be more important for women as signaling of commitment to work.

Table 16 shows the probit estimation results for the entire sample. Although the coefficients for *Female* in all model specifications are negative but their magnitude is augmented by the inclusion of the interactive term between *Female* and lagged ln*Hours*, which always has a positive coefficient. Note that the average length of leave is not

significant any more once working hours is accounted for implying that parenting leave periods affect the chance of promotion primarily through a reduction in working hours. One caveat is that the variable *births* = 2 (i.e. incidence of having two or more childbirths) is dropped because few females workers who took maternity leaves twice got promoted. There seems to be stark difference between having one child and two or more children in terms of career development.

The positive and significant coefficient of *Female* × lagged ln*Hours* clearly indicates that working hours plays more important role in the promotion decisions for women than for men. It is plausible that, by working longer, a female worker can credibly signal her commitment to work and demonstrate that her competing demands of housework and childcare do not affect her performance. This interpretation is consistent with the statistical discrimination explanation.

One problem with this analysis is that *working hours* is endogenous to many unobservable effects thus may make spurious relationship with promotion. In order to correct for such endogeneity bias, we instrumented lagged working hours and its interaction with *Female* by two commuter allowance variables and their interactions with *Female* and *Marriage* which are shown to be significantly correlated with working hours. Instrumental variable estimation results in Column 3 indicate that working hours affect promotion positively only for women. Interestingly, the coefficient of the interactive term between

Female and lagged ln*Hours* is greater in this instrumental variable estimation, although it is insignificant presumably due to the high variance in the correlation between commuter allowance and working hours for women.

Accounting for evaluation grades in the probit model estimation makes the coefficient of marriage insignificant implying that married employees get promoted with higher probability mainly because they tend to receive better evaluation (Column 4). Another interesting finding is that the interaction between *Female* and good evaluation grade is weakly significant and positive implying that getting good evaluation is more important for women than men in order to get promoted. This may indicate that: (1) the average quality of female employees with good evaluation grades is better than that of male counterparts presumably due to discrimination in evaluation; or (2) direct superiors can observe commitment shown by female subordinates and thus their evaluation has more value in promotion decisions for women.

One implication of the statistical discrimination explanation is that the bias imposed on promotion decisions for women becomes smaller as they get older because the uncertainty about workers' commitment and their family situations will be eliminated over time. Therefore, the probability of promotion will improve conditional on evaluation, efforts, and other worker characteristics that affect the performance. In order to test this hypothesis, we add the interaction between *Female* and *Age* in Column 5. The coefficient is significantly

negative and inconsistent with statistical discrimination explanation. However, it does not necessarily mean that there is no statistical discrimination. There is likely to be path-dependency in career development—women who are discriminated in early in the career may be sorted into jobs where human capital does not grow much and thus they continue to be passed over in all promotions. In such a case, the gender gap in promotion may accumulate rather than decline as employees get older.

The analyses shown in Table 17 repeat estimation of the same models for college graduates. One important difference between the results for the whole sample and those for the college graduate subsample is that promotion is not significantly correlated with lagged working hours any more for college graduate men but the correlation continue to be statistically and economically significant for college graduate women. Figure 4 compares the effects of working hours on promotion probability between men and women based on the estimation result from Model (4) in Table 17. The upper graph illustrates the predicted probability of promotion when all other covariates are set at means except for working hours whereas the lower graph shows those when the school ranking variable is set to be "top private university" and the job grade to be *SB* "highest non-managerial position for white-collar workers" (all other covariates are set at means). As the graphs indicate, working hours are strongly associated with the promotion probability for college graduate women but not for college graduate men.

The above findings imply that revealed preference for long working hours or time constraint that binds the worker does not affect the perceived competence of college graduate men but does so for college graduate women. Note that working long hours could signal a worker's commitment to work or lack of time constraint, indicate the assignment of challenging tasks, or simply mean low productivity. Since possible career interruptions due to marriage and childbirth are common concerns for most employers, they will attempt to identify the female employees who place high priority on their career development. Those who choose to work long hours to successfully accomplish their assigned tasks may credibly signal the qualities that the employers like to see.

4 Discussion and Conclusion

The gender pay gap is a persistent nature of every country's labor market (Blau 2003) and it is especially large and tenacious in the Japanese labor market. Such gender gap may be caused by the actual and expected human capital loss due to career interruptions as well as different jobs and skills men and women choose to acquire. Using detailed personnel records from a large Japanese chemical manufacturing firm, we attempt to identify the sources of large intra-firm gender gap observed in the firm. We find 19% and 28% gender pay differences among unmarried employees and married ones, respectively after controlling for basic human capital variables. Such gender gap declines substantially when accounting for

job levels and working hours. Unaccounted portion of gender pay gap is likely to be mostly caused by differences in unobserved job contents. When we restrict our analysis to college graduate employees, the gender pay gap is only a few percentage points once job levels and working hours are controlled for. As such, the most of gender pay gap among employees on the management track is caused by shorter working hours and slow promotion among women.

As primary mechanisms behind the slow promotion of women, we tested two theories explained by competing demands of housework and childcare and statistical discrimination. The data generally support the explanation by competing demands. A substantial component of gender gap in pay and promotion for married workers is explained by shorter working hours and parental leave history. Instrumental variable estimation reveals that shorter working hours actually reduce the total pay substantially. Furthermore, our probit analysis of promotion reveals that lagged working hours is the most important predictor together with evaluation grades.

We also find some evidence for statistical discrimination. First, maternity penalty is non-linear. Female workers who return to work after a short parental leave is subject to no maternity penalty although taking a long parental leave or having two childbirths results in a significant loss in income and much lower chance of promotion thereafter. Women may effectively signal their commitment to work by returning from parental leave within six

months. Second, promotion of female workers is much more strongly correlated with working hours in the previous year. This finding may indicate that women can ease the concerns of their superiors about their commitment to work by working longer but such signaling is not necessary for men. Furthermore, such correlation between promotion and lagged working hours is lower and insignificant for college graduates in case of men whereas it is even higher in case of women. It may be the case that required human capital investment is higher for management trainees and thus signaling private information regarding commitment and competing demands of housework is more important for college graduate women.

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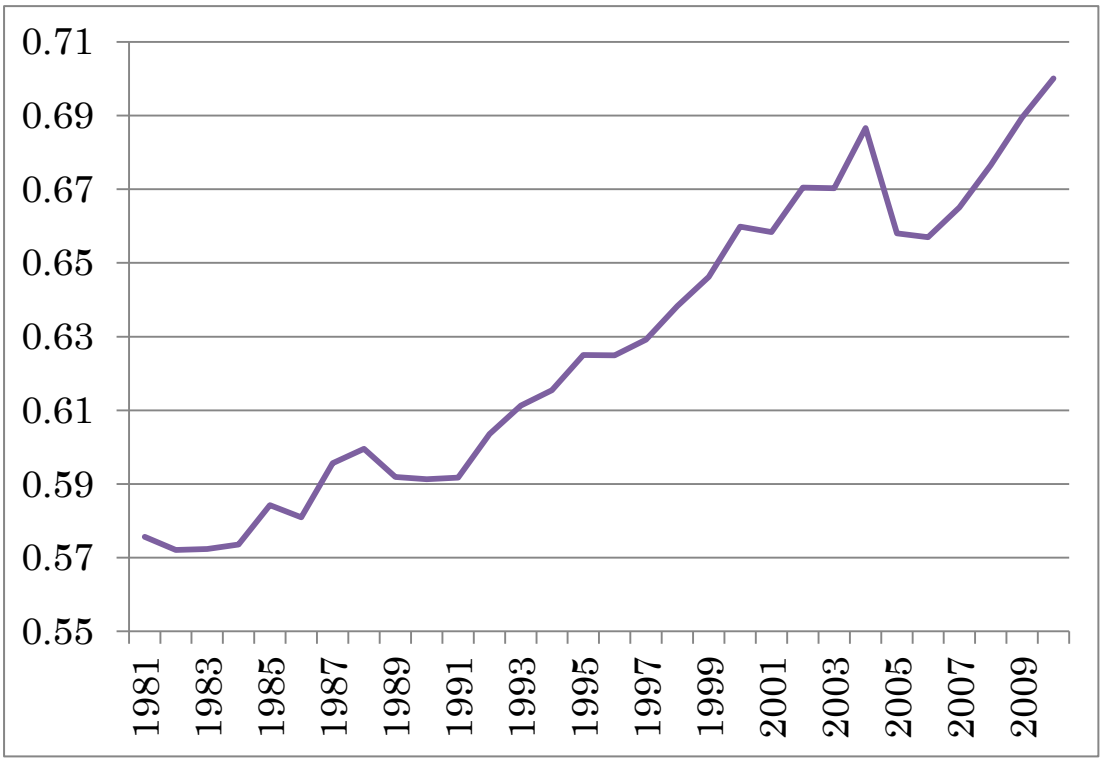
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Figure 1 Gender Pay Gap Measured by Hourly Wage in Japan.



Note: Based on the Basic Survey of Wage Structure by MHLW.

Table 1 Employees Composition by Gender and Marital Status

Fiscal Year	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*	Total
2004	18.6%	70.6%	5.9%	4.4%	0.6%	100%
2005	19.3%	69.8%	5.5%	4.2%	1.2%	100%
2006	21.6%	67.5%	5.5%	3.8%	1.6%	100%
2007	23.2%	65.6%	5.8%	3.6%	1.8%	100%
2008	25.5%	63.4%	5.5%	3.5%	2.0%	100%
2009	25.8%	63.0%	5.5%	3.5%	2.2%	100%

Note: Include only regular workers. * shows the number of female workers who have taken parental leave after FY1998. This last group also includes those who got divorced after having children.

Table 2 Annual Wage, Average Age, Working Hours, Hourly Wage by Gender and Marital Status

Average Annual Wage

Fiscal Year	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*
2005	5,900,233	8,087,088	5,222,444	5,157,902	4,403,632
2006	5,961,231	8,198,714	5,402,587	5,405,735	4,471,967
2007	5,922,937	8,265,332	5,582,436	5,763,785	4,839,741
2008	5,803,538	8,186,499	5,469,831	5,811,252	4,825,612
2009	5,275,211	7,570,200	5,057,443	5,437,273	4,560,014
Average	5,772,630	8,061,567	5,346,948	5,515,189	4,620,193

Average Age

Fiscal Year	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*
2005	34.9	44.4	37.3	36.7	34.8
2006	34.7	44.3	37.9	37.6	35.0
2007	34.0	43.9	38.0	38.9	36.2
2008	33.3	43.4	37.7	39.9	36.5
2009	32.9	43.1	38.2	40.4	37.4
Average	33.9	43.8	37.8	38.7	36.0

Average Annual Working Hours

Fiscal Year	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*
2005	2,072	2,060	1,922	1,794	1,667
2006	2,090	2,073	1,945	1,821	1,640
2007	2,095	2,091	1,950	1,838	1,588
2008	2,112	2,089	1,919	1,821	1,613
2009	2,059	2,034	1,854	1,782	1,588
Average	2,086	2,069	1,918	1,811	1,619

Average Hourly Wage

Fiscal Year	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*
2005	2,868	3,966	2,715	2,869	2,645
2006	2,872	3,999	2,783	2,966	2,736
2007	2,849	3,998	2,873	3,140	3,059
2008	2,769	3,967	2,862	3,199	2,994
2009	2,576	3,762	2,745	3,054	2,873
Average	2,787	3,938	2,795	3,046	2,861

Note: The figures in the table only include those who work for twelve months in each fiscal year. Hence, women who took a parental leave in the fiscal year are not included.

Table 3 Distribution of Men and Women by Education levels

Men

Year of Hiring	Ph.D.	Master	College	College of Tech.	2-y college	Vocatio-nal Sch.	High School	Middle School	UNK	Total
1990	5	55	93	23	2	8	166	7	1	360
1991	4	41	75	25	2	7	198	1	0	353
1992	2	66	68	20	2	6	134	6	0	304
1993	5	58	47	13	2	7	92	1	0	225
1994	4	37	19	18	0	1	21	0	0	100
1995	2	19	26	11	1	7	41	0	0	107
1996	4	16	33	2	0	8	56	0	0	119
1997	4	15	34	9	2	12	71	0	0	147
1998	0	27	34	11	0	10	47	0	1	130
1999	4	24	17	7	3	5	30	0	0	90
2000	2	22	44	3	1	7	59	2	0	140
2001	1	33	70	3	3	21	99	1	1	232
2002	5	26	22	5	0	5	38	0	0	101
2003	5	13	47	3	1	7	32	0	0	108
2004	9	28	50	8	2	5	34	0	0	136
2005	10	43	87	6	1	12	71	0	47	277
2006	15	66	116	13	6	11	94	1	54	376
2007	17	73	95	9	4	27	129	0	59	413
2008	22	109	124	21	5	25	148	2	36	492
2009	13	93	79	11	1	8	83	0	10	298
1990-99	1.8%	18.5%	23.0%	7.2%	0.7%	3.7%	44.2%	0.8%	0.1%	100.0%
2000-09	3.8%	19.7%	28.5%	3.2%	0.9%	5.0%	30.6%	0.2%	8.0%	100.0%

Women

Year of Hiring	Ph.D.	Master	College	College of Tech.	2-y college	Vocation al Sch.	High School	Middle School	UNK	Total
1990	0	2	5	1	20	4	22	0	0	54
1991	0	1	10	0	26	7	28	0	0	72
1992	0	2	16	0	34	3	22	0	0	77
1993	0	1	10	2	30	3	23	0	1	70
1994	0	1	1	0	6	2	6	0	0	16
1995	0	1	1	1	11	2	1	0	0	17
1996	0	0	5	0	8	2	9	0	0	24
1997	0	2	6	1	6	7	10	0	0	32
1998	0	1	2	0	6	6	8	0	0	23
1999	1	2	3	0	1	2	4	0	0	13
2000	1	2	1	0	3	4	0	0	0	11
2001	0	6	5	0	2	6	1	0	0	20
2002	0	4	6	0	0	13	1	0	0	24
2003	0	0	2	0	1	9	0	0	0	12
2004	0	4	5	1	0	6	0	0	0	16
2005	3	8	7	0	0	4	2	0	1	25
2006	0	14	12	0	2	6	0	0	6	40
2007	3	20	18	3	0	4	1	0	4	53
2008	4	9	18	3	1	7	5	0	13	60
2009	2	15	13	3	2	3	7	0	1	46
1990-99	0.3%	3.3%	14.8%	1.3%	37.2%	9.5%	33.4%	0.0%	0.3%	100.0%
2000-09	4.2%	26.7%	28.3%	3.3%	3.6%	20.2%	5.5%	0.0%	8.1%	100.0%

Note: The employees hired before 2004 include only those who were still employed in 2004. UNK stands for unknown.

Figure 2 Promotion Path Chart

G1

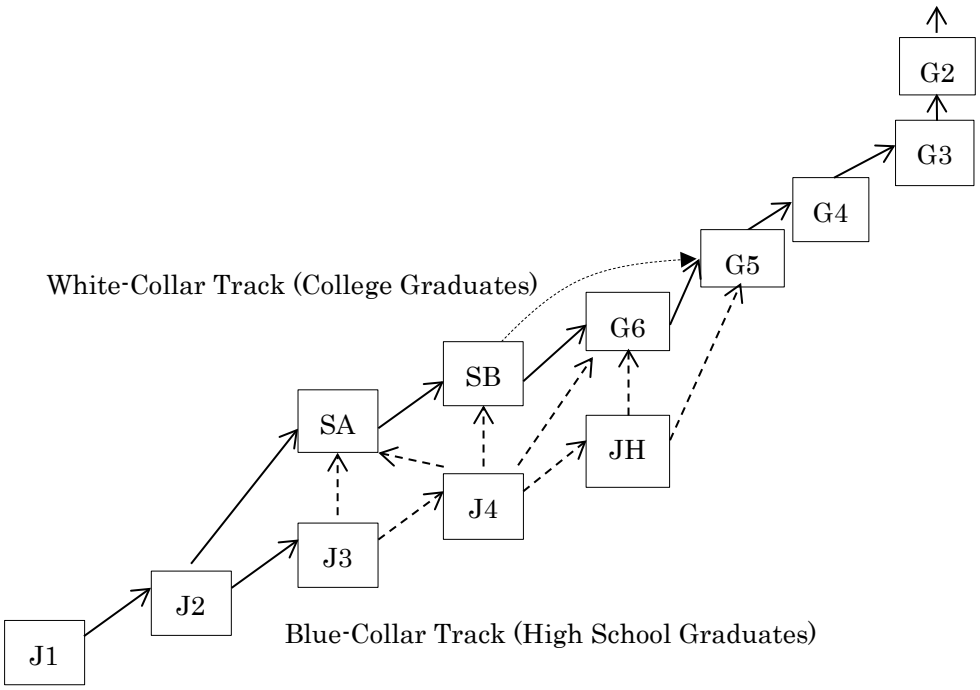

G2
G3
G4
G5
White-Collar Track (College Graduates)
G6
SB
SA
JH
J4
J3
J2
J1
Blue-Collar Track (High School Graduates)

Table 4 Distribution of Men and Women in Hierarchy

As of 2004

Job Grades	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*	Total
J1	3.09%	1.77%	0.30%	0.08%	0.00%	5.24%
J2, J3	8.88%	27.73%	4.89%	3.63%	0.57%	45.68%
SA, J4	2.29%	8.64%	0.31%	0.11%	0.01%	11.37%
SB, JH	1.54%	4.56%	0.11%	0.11%	0.00%	6.33%
G6	1.10%	4.04%	0.13%	0.25%	0.03%	5.55%
G5	1.22%	10.61%	0.14%	0.17%	0.00%	12.14%
G4	0.44%	8.71%	0.03%	0.08%	0.00%	9.26%
G3	0.08%	3.53%	0.01%	0.00%	0.00%	3.63%
G1,G2	0.01%	0.79%	0.00%	0.00%	0.00%	0.81%
Total	18.66%	70.36%	5.92%	4.45%	0.61%	100.00%
Management-track	202	1,954	22	36	2	2,216
(G6 or higher)	9.1%	88.2%	1.0%	1.6%	0.1%	100.0%
Senior Managers	38	920	3	6	0	967
(G4 or higher)	3.9%	95.1%	0.3%	0.6%	0.0%	100.0%

As of 2009

Job Level	Single Men	Married Men	Single Women	Married Women without Small Children	Married Women with Small Children*	Total
J1	6.91%	3.04%	0.59%	0.11%	0.01%	10.63%
J2, J3	8.77%	20.65%	3.36%	2.32%	1.78%	36.85%
SA, J4	4.94%	8.17%	0.93%	0.37%	0.10%	14.52%
SB, JH	2.45%	4.84%	0.32%	0.17%	0.15%	7.93%
G6	0.92%	4.06%	0.13%	0.15%	0.15%	5.42%
G5	1.15%	8.07%	0.14%	0.18%	0.04%	9.58%
G4	0.64%	9.51%	0.08%	0.13%	0.00%	10.34%
G3	0.11%	3.81%	0.00%	0.04%	0.00%	3.96%
G1,G2	0.01%	0.77%	0.00%	0.00%	0.00%	0.78%
Total	25.91%	62.92%	5.54%	3.47%	2.23%	100.00%
Management-track	222	2,053	27	39	15	2,355
(G6 or higher)	9.4%	87.2%	1.1%	1.7%	0.6%	100.0%
Senior Managers	60	1,103	6	13	0	1,181
(G4 or higher)	5.1%	93.4%	0.5%	1.1%	0.0%	100.0%

Table 6 Frequency of Promotion by job level, gender, and marital status (2004-2009)

	Single Men			Married Men			Men Total		
Job Grades	# of employees	Freq. of promotions	Promotion rate	# of employees	Freq. of promotions	Promotion rate	# of employees	Freq. of promotions	Promotion rate
J1	2646	696	26.3%	1241	277	22.3%	3887	973	25.0%
J2, J3	3746	136	3.6%	10495	515	4.9%	14241	651	4.6%
SA, J4	1483	227	15.3%	3721	242	6.5%	5204	469	9.0%
SB, JH	830	103	12.4%	2024	265	13.1%	2854	368	12.9%
G6	436	65	14.9%	1669	298	17.9%	2105	363	17.2%
G5	559	41	7.3%	4146	485	11.7%	4705	526	11.2%
G4	238	12	5.0%	4069	280	6.9%	4307	292	6.8%
G3	51	2	3.9%	1659	106	6.4%	1710	108	6.3%

	Single Women			Married Women without Small Children			Married Women with Small Children*			Women Total		
Job Grades	# of employees	Freq. of promotions	Promotion rate	# of employees	Freq. of promotions	Promotion rate	# of employees	Freq. of promotions	Promotion rate	# of employees	Freq. of promotions	Promotion rate
J1	215	130	60.5%	40	18	45.0%	6	2	33.3%	261	150	57.5%
J2, J3	1782	38	2.1%	1281	15	1.2%	606	2	0.3%	3669	55	1.5%
SA, J4	280	35	12.5%	96	14	14.6%	24	0	0.0%	400	49	12.3%
SB, JH	83	7	8.4%	57	10	17.5%	31	1	3.2%	171	18	10.5%
G6	54	6	11.1%	93	9	9.7%	43	1	2.3%	190	16	8.4%
G5	69	4	5.8%	80	4	5.0%	11	0	0.0%	160	8	5.0%
G4	18	0	0.0%	37	2	5.4%	0	0	0.0%	55	2	3.6%
G3	5	0	0.0%	15	0	0.0%	0	0	0.0%	20	0	0.0%

Figure 3 Separation rate by age, gender, and marital status

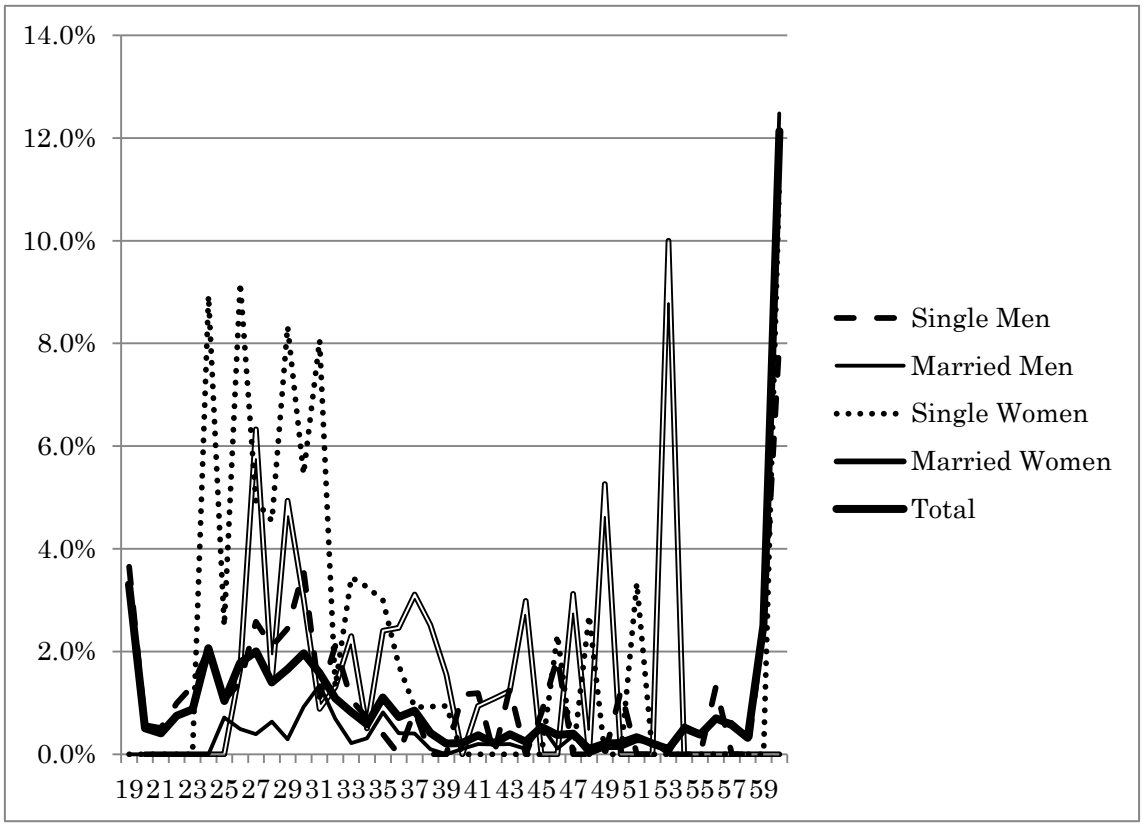


Table 7 Random Effect Model Estimation of Gender Pay Gap

Dependent variable	**ln(total pay)**			**ln(hourly wage)**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Base	**w. education**	**Graduated in FY1987 and after**	**Base**	**w. education**	**Graduated in FY1987 and after**
Marriage	**0.0636 *****	**0.0670 *****	**0.0673 *****	**0.0821 *****	**0.0828 *****	**0.0883 *****
	(0.0032)	**(0.0031)**	**(0.0031)**	**(0.0038)**	**(0.0037)**	**(0.0037)**
Female	**-0.2164 *****	**-0.1927 *****	**-0.1478 *****	**-0.1234 *****	**-0.1229 *****	**-0.0896 *****
	(0.0073)	**(0.0075)**	**0.0077**	**(0.0067)**	**(0.0069)**	**(0.0077)**
Marriage × Female	**-0.0817 *****	**-0.0826 *****	**-0.0948 *****	**-0.0546 *****	**-0.0488 *****	**-0.0641 *****
	(0.0072)	**(0.0069)**	**0.0071**	**(0.0078)**	**(0.0075)**	**(0.0078)**
Education (base: high school)						
Ph.D.		0.3711 ***	0.2783 ***		0.2720 ***	0.1653 ***
		(0.0111)	(0.0109)		(0.0124)	(0.0122)
Master		0.3150 ***	0.2202 ***		0.2165 ***	0.1078 ***
		(0.0051)	(0.0053)		(0.0058)	(0.0059)
College		0.1982 ***	0.1201 ***		0.1454 ***	0.0637 ***
		(0.0059)	0.0056		(0.0057)	(0.0056)
College of technology		0.1470 ***	0.0937 ***		0.0275 ***	-0.0312 **
		(0.0059)	(0.0060)		(0.0062)	(0.0061)
2-year college		-0.0521 ***	-0.0967 ***		-0.0299 ***	-0.0786 ***
		(0.0090)	(0.0093)		(0.0071)	(0.0077)
Middle school		-0.1162 ***	0.0172		-0.0842 ***	0.0694
		(0.0074)	(0.0677)		(0.0073)	(0.0768)
Vocational school		0.0162 *	-0.0291 ***		0.0265 ***	-0.0191 **
		(0.0092)	(0.0101)		(0.0080)	(0.0082)
Vocational school (medical)		0.1488 ***	0.0747 ***		0.1752 ***	0.0969 ***
		(0.0130)	0.0128		(0.0145)	(0.0169)
Control for age and tenure	Yes	Yes	Yes	Yes	Yes	Yes
Control for fiscal year	Yes	Yes	Yes	Yes	Yes	Yes
R2 overall	0.6493	0.7749	0.8338	0.6400	0.7108	0.7266
sigma_u	0.1893	0.1508	0.1118	0.1593	0.1401	0.1107
sigma_e	0.0575	0.0572	0.0622	0.0624	0.0625	0.0597
Number of observations	41820	41063	22084	30339	29757	16419
Number of employees	9251	8998	5027	8174	7952	4514

Table 8 Trend of Gender Pay Gap and Marriage Premium

	R2	**Gender Pay Gap/Marriage Premium**		
		Single	Married	Marriage Premium for Men
2004	0.7980	-0.1856	-0.3191	0.1050
2005	0.7891	-0.1818	-0.3274	0.1035
2006	0.7715	-0.1606	-0.3161	0.1076
2007	0.7747	-0.1530	-0.2999	0.1102
2008	0.7819	-0.1506	-0.2959	0.1040
2009	0.7748	-0.1561	-0.2995	0.1120

Note: Based on the coefficients of random effect model estimation repeated for each year. The other independent variables include age (fourth degree polynomial), tenure (quadratic), education, year dummies.

Table 9 Explaining the gender pay gap

Dependent Variable: ln(total pay)

	Independent variables	**R2**	**Gender Pay Gap/Marriage Premium**		
			Single	Married	Marriage P. for Men
Model 1	Age, tenure, and fiscal year dummies	0.6492	-0.2167	-0.2977	0.0634
Model 2	＋education	0.7751	-0.1924	-0.2733	0.0668
Model 3	＋# of dependents	0.7761	-0.1902	-0.2648	0.0630
Model 4	＋job grade, job skill rank	0.9017	-0.1107	-0.1985	0.0576
Model 5	＋evaluation	0.9031	-0.1103	-0.1982	0.0570
Model 6	＋establishment	0.9062	-0.1197	-0.2055	0.0579

Dependent Variable: ln(hourly wage)

	Independent variables	**R2**	**Gender Pay Gap/Marriage Premium**		
			Single	Married	Marriage P. for Men
Model 1	Age, tenure, and f. year dummies	0.6399	-0.1233	-0.1776	0.0821
Model 2	＋education	0.7108	-0.1222	-0.1696	0.0827
Model 3	＋# of dependents	0.7145	-0.1116	-0.1365	0.0632
Model 4	＋job grade, job skill rank	0.8039	-0.0681	-0.0981	0.0560
Model 5	＋evaluation	0.8037	-0.0702	-0.0997	0.0560
Model 6	＋establishment	0.8185	-0.0950	-0.1152	0.0563

Table 10 Explaining the gender pay gap—only college graduates

Dependent Variable: ln(total pay)

	Independent variables	**R2**	**Gender Pay Gap/Marriage Premium**		
			Single	Married	Marriage Prem. for Men
Model 1	Age, tenure, and f. year dummies	0.7312	-0.1240	-0.2012	0.0731
Model 2	＋university ranking	0.7877	-0.1302	-0.2038	0.0723
Model 3	＋# of dependents	0.7884	-0.1263	-0.1962	0.0694
Model 4	＋job grade, job skill rank	0.9098	-0.0568	-0.1309	0.0696
Model 5	＋evaluation	0.9102	-0.0556	-0.1299	0.0688
Model 6	＋establishment	0.9127	-0.0639	-0.1397	0.0698

Dependent Variable: ln(hourly wage)

	Independent variables	**R2**	**Gender Pay Gap/Marriage Premium**		
			Single	Married	Marriage P. for Men
Model 1	Age, tenure, and f. year dummies	0.6990	-0.0880	-0.1261	0.1039
Model 2	＋university ranking	0.7556	-0.0885	-0.1211	0.1007
Model 3	＋# of dependents	0.7576	-0.0734	-0.0744	0.0817
Model 4	＋job grade, job skill rank	0.8361	-0.0211	-0.0357	0.0752
Model 5	＋evaluation	0.8349	-0.0249	-0.0367	0.0741
Model 6	＋establishment	0.8492	-0.0484	-0.0588	0.0741

Table 11: Ordered Logit Estimation of Promotion

Dependent variables	All employees						College graduates					
Job Grade	(1)		(2)		(3)		(4)		(5)			
Marriage	0.5315	***	0.434	***	0.6181	***	0.4958	***	0.4378	***		
	(0.0263)		(0.0264)		(0.0530)		(0.0536)		(0.0546)			
Female	-0.3445	***	-0.6202	***	-0.3615	***	-0.4253	***	-0.5828	***		
	(0.0522)		(0.0575)		(0.1057)		(0.0969)		(0.1078)			
Marriage × Female	-0.5178	***	-0.2482	***	-0.5749	**	-0.5201	**	-0.3884	**		
	(0.0582)		(0.0645)		(0.1438)		(0.1426)		(0.1578)			
Evaluation (base: A2)												
A1 or better			0.4504	***					0.5236	***		
			(0.0211)						(0.0481)			
A3 or worse			-0.2695	***					-0.109			
			(0.0288)						(0.0719)			
Working in the HQ			1.795	***					1.0345	***		
			(0.0348)						(0.0458)			
Education (base: high school)												
Ph.D.	3.7292	***	3.6972	***								
	(0.0401)		(0.0428)									
Master	3.555	***	3.4472	***								
	(0.0307)		(0.0323)									
College	2.5219	***	1.9778	***								
	(0.0415)		(0.0444)									
College of technology	2.6469	***	2.7025	***								
	(0.0327)		(0.0338)									
2-year college	-0.2572	***	-0.5029	***								
	(0.0458)		(0.0530)									
University ranking (base:3rd-tier)												
National 1st tier							3.0009	***	2.6036	***		
							(0.0651)		(0.0684)			
National 2nd tier							2.5371	***	2.2744	***		
							(0.0660)		(0.0680)			
Private 1st tier							2.8269	***	2.3527	***		
							(0.0627)		(0.0672)			
Private 2nd tier							1.8576	***	1.4539	***		
							(0.0761)		(0.0789)			
Control for age and tenure	Yes		Yes		Yes		Yes		Yes			
Control for fiscal year	Yes		Yes		Yes		Yes		Yes			
Pseudo R^2	0.2266		0.2511		0.1456		0.2437		0.2595			
Number of observations	41553		40939		8272		8272		8221			

Table 12 Estimation of Maternity Penalty on Wage Income

Dependent Variable: ln(total wage)	All employees		Women only			
	Random Effect		Random Effect	Fixed Effect		FE-2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Marriage	0.0635***	0.0510***	0.0198***	0.0006	0.0180***	0.0248***
	(0.0031)	(0.0032)	(0.0056)	(0.0068)	(0.0063)	(0.0065)
Female	-0.1796***	-0.1518***				
	(0.0075)	(0.0076)				
Marriage × Female	-0.0660***	-0.0374***				
	(0.0067)	(0.0067)				
# of dependents	0.0114***	0.0305***	0.0229**	0.0236***	0.0202*	0.0056
	(0.0013)	(0.0023)	(0.0096)	(0.0071)	(0.0113)	(0.0074)
One maternity leave spell (*births*=1)	0.0230*	0.0248**	0.0194**	0.0140	0.0220**	0.0275***
	(0.0129)	(0.0113)	(0.0079)	(0.0134)	(0.0094)	(0.0097)
Two or more maternity leave spells (*births*=2)	-0.0529**	0.0072	0.0096	-0.0565***	0.0168	0.0037
	(0.0213)	(0.0182)	(0.0169)	(0.0219)	(0.0242)	(0.0276)
Average length of leave in months (*leave_pd*)	-0.0082***	-0.0046***	-0.0037***	-0.0098***	-0.0051***	-0.0039**
	(0.0010)	(0.0008)	(0.0006)	(0.0017)	(0.0013)	(0.0017)
Working in the HQ	0.0423***	0.0535***	0.0212**	0.0215	0.0203*	0.0211***
	(0.0041)	(0.0045)	(0.0100)	(0.0133)	(0.0123)	(0.0075)
Working Hours (ln(*hours*))		0.3584***	0.5253***		0.5086***	0.6751***
		(0.0095)	(0.0198)		(0.0213)	(0.1361)
Control for age and tenure	Yes	Yes	Yes	Yes	Yes	Yes
Control for education	Yes	Yes	Yes			
Control for fiscal year	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.7845	0.8008	0.7084	0.6240	0.4413	0.4099
# of observations	41063	29771	2953	4147	2953	2683
# of employees	8998	7956	822	941	822	748

Table 13 Estimation of Maternity Penalty on Wage Income—For College Graduates

Dependent variable ln(total wage)	All employees				Women only								
	Random Effect				Random Effect		Fixed Effect				FE-2SLS		
	(1)		(2)		(3)		(4)		(5)		(6)		
Marriage	0.0550	***	0.0601	***	0.0406	***	0.0313		0.0323	**	0.0323	**	
	(0.0070)		(0.0065)		(0.0146)		(0.0192)		(0.0152)		(0.0152)		
Female	-0.1310	***	-0.1107	***									
	(0.0188)		(0.0179)										
Marriage × Female	-0.0230		-0.0212										
	(0.0193)		(0.0175)										
# of dependents	0.0357	***	0.0372	***	0.0505		0.1047	**	0.0970	**	0.0970	**	
	(0.0058)		(0.0053)		(0.0438)		(0.0500)		(0.0446)		(0.0446)		
One maternity leave spell (*births*=1)	0.0014		0.0167		0.0184		0.0280	*	0.0775	***	0.0775	***	
	(0.0344)		(0.0328)		(0.0358)		(0.0146)		(0.0165)		(0.0165)		
Two or more maternity leave spells (*births*=2)													
Average length of leave in months (*leave_pd*)	-0.0075	**	-0.0057	**	-0.0072	**	-0.0308	***	-0.0301	***	-0.0301	***	
	(0.0030)		(0.0028)		(0.0030)		(0.0057)		(0.0050)		(0.0050)		
Working in the HQ	0.0281	***	0.0337	***	-0.0053		-0.0094		-0.0005		-0.0005		
	(0.0072)		(0.0073)		(0.0116)		(0.0146)		(0.0119)		(0.0119)		
Working Hours (ln(*hours*))			0.3023	***	0.4408	***			0.4240	***	0.4240	***	
			(0.0212)		(0.0633)				(0.0668)		(0.0668)		
Control for age and tenure	Yes		Yes		Yes		Yes		Yes		Yes		
Control for school ranking	Yes		Yes		Yes		Yes		Yes		Yes		
Control for fiscal year	Yes		Yes		Yes		Yes		Yes		Yes		
R2	0.7969		0.8098		0.0356		0.0498		0.0498		0.0498		
# of observations	5963		5969		552		552		552		552		
# of employees	1643		1643		156		156		156		156		

Table 14 Impact of Parental Leave Period on Future Income

Sample: all female regular employees	Parental Leave Period			
	3 months	12 months	2 years	12 months × 2 children
Random effect model	-0.20%	-7.50%	-17.40%	-25.00%
Fixed effect (FE) model	-1.50%	-10.40%	-22.10%	-29.20%
FE model with working hours as control	0.70%	-3.90%	-10.00%	-10.00%
FE-2SLS with endogenous working hours	1.60%	-1.90%	-6.60%	-9.00%

Sample: college graduate female regular employees	Parental Leave Period			
	3 months	12 months	2 years	12 months × 2 children
Random effect model	-2.10%	-8.90%	N.A.	N.A.
Fixed effect (FE) model	-1.50%	-34.20%	N.A.	N.A.
FE model with working hours as control	-1.30%	-25.70%	N.A.	N.A.
FE-2SLS with endogenous working hours	-1.30%	-26.40%	N.A.	N.A.

Table 15 Random Effect Estimation of Working Hours

	All Employees	Men	Women	College Graduates	College Graduate Men	College Graduate Women
Marriage	-5.14	-5.72	-71.10 ***	-37.20 ***	-38.73 ***	-55.86
	(5.82)	(6.20)	(12.66)	(13.56)	(14.29)	(37.24)
Female	-127.64 ***			-107.00 ***		
	(10.10)			(21.60)		
Marriage × Female	-65.69 ***			-5.45		
	-12.09			(29.40)		
# of dependents	3.98	2.08	23.43 *	6.99	4.19	35.02
	(3.64)	(3.81)	(13.29)	(8.68)	(8.97)	(48.60)
One maternity leave spell (childbirth)	-64.54 ***		-68.60 ***	-63.89		-72.00
	(23.40)		(18.69)	(75.94)		(65.20)
Two or more spells (childbirths)	-181.70 ***		-159.77 ***			
	(47.30)		(38.29)			
Average length of leave (months)	-11.40 ***	-48.63 ***	-9.02 ***	-14.90 ***	-52.40	-10.38 **
	(1.42)	(13.38)	(1.16)	(5.17)	(37.90)	(4.72)
Commuter Allowance/Wage Ratio	-1195.10 ***	-1288.10 ***	-1040.39 ***	-1143.36 ***	-1201.00 ***	-1184.70 *
	(147.30)	(171.95)	(248.61)	(321.10)	(358.60)	(700.90)
Marriage × Commuter Allowance Ratio	-466.74 ***	-449.50 **	-79.99	-283.70	-235.97 ***	152.95
	(165.75)	(190.30)	(304.66)	(349.40)	(387.27)	(836.52)
No Commuter Allowance	-15.96 ***	-17.33 ***	-12.85	-25.60 **	-23.57 **	-64.30 **
	(4.58)	(4.86)	(13.44)	(10.30)	(10.78)	(35.80)
Working in the HQ	-57.95 ***	-68.49 ***	22.11 *	-36.60 ***	-37.00 ***	-26.30
	(5.29)	(5.72)	(12.86)	(9.20)	(9.80)	(26.80)
Control for education /school ranking	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.2081	0.1297	0.3666	0.1202	0.0881	0.2678
# of observations	30351	27351	3000	5969	5417	552
# of employees	8177	7333	844	1643	1487	156
Rho	0.6695	0.6627	0.7155	0.6803	0.6691	0.7739

Table 16 Probit Estimation of Promotion

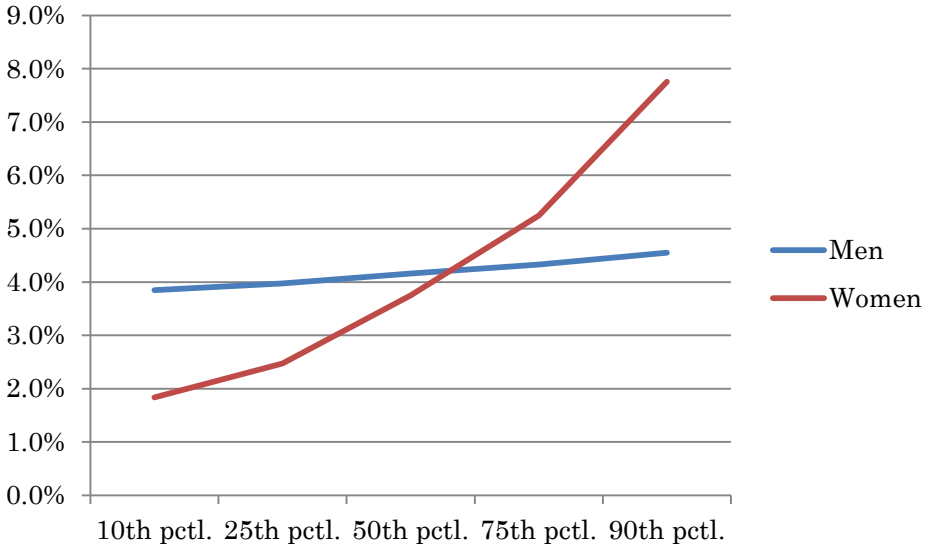
	Base Probit (1)	w. hours Probit (2)	w. hours IV-Probit (3)	w. evaluation Probit (4)	w. female×age Probit (5)
Marriage	0.1325 ***	0.1138 ***	0.1296 ***	0.0361	0.0255
	(0.0311)	(0.0369)	(0.0381)	(0.0379)	(0.0380)
Female	-0.1163 **	-9.9136 ***	-16.0798	-10.6210 **	-8.1356 **
	(0.0590)	(3.0172)	(11.0600)	(3.2817)	(3.5446)
Marriage × Female	-0.0849	0.0939	- -	0.1185	0.1277
	(0.0859)	(0.1020)		(0.1042)	(0.1040)
Female × age					-0.0184 **
					(0.0081)
One maternity leave spell (childbirth)	-0.0454	-0.0568	-0.0046	-0.0932	-0.1456
	(0.1451)	(0.2009)	(0.2544)	(0.2065)	(0.2108)
Two or more spells (childbirths)					
Average length of leave (months)	-0.0388 ***	-0.0160	-0.0135	-0.0124	-0.0121
	(0.0120)	(0.0133)	(0.2000)	(0.0143)	(0.0142)
Lagged working in the HQ	0.3229 ***	0.3780 ***	0.3276 ***	0.3999 ***	0.4154 ***
	(0.0427)	0.0508	(0.0799)	(0.0523)	(0.0533)
Lagged working hours (log)		0.6383 ***	-0.2813	0.3616 **	0.3910 **
		(0.1523)	(1.0967)	(0.1567)	(0.1569)
Female × Lagged working hours		1.2933 ***	2.1089	1.3720 ***	1.1315 **
		(0.4157)	(1.4578)	(0.4302)	(0.4543)
Evaluation					
A1 or better				0.4657 ***	0.4673 ***
				(0.0352)	(0.0353)
A3 or worse				-0.3884 ***	-0.3927 ***
				(0.0627)	(0.0628)
Female × A1 or better				0.1958 *	0.2106 **
				(0.1025)	(0.1065)
Female × A3 or worse				0.1457	0.1580
				(0.1918)	(0.1933)
Education					
Ph.D.	1.0909 ***	0.7264 ***	0.6928 ***	0.7897 ***	0.8090 ***
	(0.0798)	(0.0982)	(0.1324)	(0.0993)	(0.1008)
Master	0.6718 ***	0.6917 ***	0.6761 ***	0.7666 ***	0.7774 ***
	(0.0566)	(0.0660)	(0.0725)	(0.0662)	(0.0672)
College	0.3550 ***	0.3424 ***	0.3242 ***	0.3940 ***	0.4020 ***
	(0.0453)	(0.0520)	(0.0537)	(0.0527)	(0.0533)
College of technology	0.4221 ***	0.3700 ***	0.3926 ***	0.4350 ***	0.4380 ***
	(0.0523)	(0.0638)	(0.0733)	(0.0653)	(0.0656)
2-year college	-0.0840	-0.0987	-0.0910	-0.1765 **	-0.1839 *
	(0.0851)	(0.0949)	(0.1114)	(0.0964)	(0.0972)
Control for age/tenure	Yes	Yes	Yes	Yes	Yes
Control for job grade	Yes	Yes	Yes	Yes	Yes
Control for fiscal year	Yes	Yes	Yes	Yes	Yes
Number of observations	31433	21523	21523	21286	21286

Table 17 Probit Estimation of Promotion—College Graduates

	Base Probit (1)	w. hours Probit (2)	w. hours IV-Probit (3)	w. evaluation Probit (4)	w. female×age Probit (5)
Marriage	0.0811	0.0482	0.0292	-0.0061	-0.0212
	(0.0634)	(0.0793)	(0.0821)	(0.0802)	(0.0801)
Female	-0.1019	-15.0876 **	-54.5677	-16.2202 ***	-11.7620
	(0.1230)	(6.1802)	(41.8500)	(6.2303)	(7.4655)
Marriage × Female	-0.1881	-0.1859	- -	-0.1981	-0.1029
	(0.1837)	(0.2182)		(0.2245)	(0.2294)
Female × age					-0.0320 *
					(0.0195)
One maternity leave spell (childbirth)	-0.0324	0.1082	0.0143	0.0002	-0.0385
	(0.4068)	(0.4511)	(0.4956)	(0.4435)	(0.4470)
Two or more spells (childbirths)					
Average length of leave (months)	-0.0309	0.0165	0.0623	0.0290	0.0288
	(0.0203)	(0.0221)	(0.0578)	(0.0240)	(0.0236)
Lagged working in the HQ	0.2558 ***	0.3658 ***	0.4172 ***	0.3755 ***	0.3933 ***
	(0.0628)	(0.0804)	(0.1280)	(0.0819)	(0.0836)
Lagged working hours (log)		0.4698	-0.2813	0.2811	0.3155
		(0.2971)	(1.0967)	(0.3082)	(0.3079)
Female × Lagged working hours		1.9724 **	2.1089	2.1089 ***	1.6666 *
		(0.8073)	(1.4578)	(0.8169)	(0.9429)
Evaluation					
A1 or better				0.3627 ***	0.3619 ***
				(0.0762)	(0.0761)
A3 or worse				-0.2556 **	-0.2671 **
				(0.1188)	(0.1193)
Female × A1 or better				0.1604	0.1472
				(0.2606)	(0.2653)
Female × A3 or worse				0.4165	0.4909
				(0.3489)	(0.3680)
Education					
National 1st tier	0.2624 ***	0.1215	0.1183	0.1345	0.1269
	(0.0967)	(0.1246)	(0.1414)	(0.1258)	(0.1270)
National 2nd tier	0.2475 **	0.3007 **	0.2647 *	0.3087 **	0.3099 **
	(0.0976)	(0.1239)	(0.1389)	(0.1239)	(0.1248)
Private 1st tier	0.3632 ***	0.3444 ***	0.3430 **	0.3231 ***	0.3182 ***
	(0.0870)	(0.1059)	(0.1399)	(0.1087)	(0.1098)
Private 2nd tier	0.2467 ***	0.1642 *	0.1646	0.1817 *	0.1871 *
	(0.0807)	(0.0996)	(0.1179)	(0.1010)	(0.1014)
Control for age/tenure	Yes	Yes	Yes	Yes	Yes
Control for job grade	Yes	Yes	Yes	Yes	Yes
Control for fiscal year	5731	3883	3883	3872	3872
Number of observations	0.0811	0.0482	0.0292	-0.0061	-0.0212

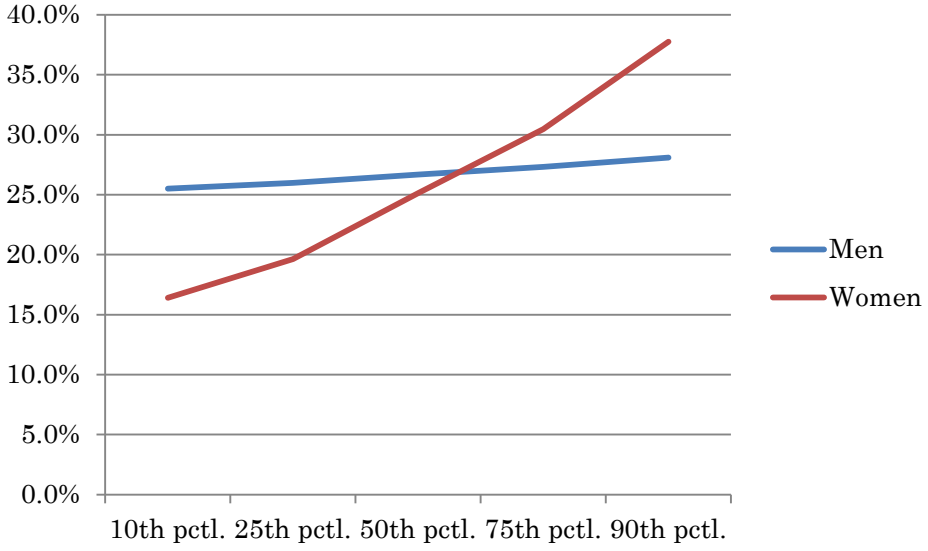
Figure 4 Impact of Working Hours on Promotion Probability for College Graduate Employees

Case when setting all other covariates at means



Percentile of working hour distribution of all employees

Case when school quality is set to be "top private university graduates" and job grade to be *SB* "highest management trainee position (next level is a manager)". Other covariates are set at means.



Percentile of working hour distribution of all employees

Note: Both predicted values are based on Model (4) in Table 17.