RIETI Discussion Paper Series 16-E-099

Glass Ceilings or Sticky Floors?

An analysis of the gender wage gap across the wage distribution in Japan

HARA Hiromi

Japan Women's University

Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry

http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 16-E-099

November 2016

Glass Ceilings or Sticky Floors? An analysis of the gender wage gap across the wage distribution in Japan*

HARA Hiromi

Japan Women's University and TCER

Abstract

This study examines the gender wage gap across the wage distribution in Japan using large sample data for 1990, 2000, and 2014. The results of the Firpo-Fortin-Lemieux decomposition show that the part of the observed gender gap that is not explained by gender differences in human capital is larger at the top and at the bottom of the wage distribution, indicating that both a glass ceiling and a sticky floor exist for women in the Japanese labor market. The sticky floor could be explained by female workers being segregated into non-career track jobs, while the glass ceiling could be due to gender differences in the quality of education. Furthermore, this study also finds that while the gender wage gap has been declining from 1990 to 2014 at all quantiles of the wage distribution, the decline in gender gap of human capital attributes contributes to it. However, the glass ceiling and the sticky floor phenomena, observed since 1990, persist.

Keywords: Gender wage gap, Glass ceiling, Sticky floor, Wage distribution

JEL classification: J16, J31, J24

* This study is conducted as a part of the Project "Transformation of the Japanese Labor Market: Toward a labor market for all" undertaken at Research Institute of Economy, Trade and Industry (RIETI). I would like to express my appreciation to the following people for their helpful comments: Izumi Yokoyama, Ayako Kondo, Keisuke Kawata, Hideo Owan, Takahiro Itoh, Todd Sorensen, and Daiji Kawaguchi. In addition, I would like to thank the participants of the Tokyo Labor Economics Workshop (Oct. 2015, Tokyo), and Discussion Paper seminar at RIETI (Aug. 2016, Tokyo), the Asian Meeting of Econometric Society (Aug. 2016, Kyoto), the IZA Brown Bag Seminar (Aug. 2016, Bonn), the 2016 Fall Meeting of the Japanese Economic Association (Sep. 2016, Tokyo). Permission for the use of micro data from the *Basic Survey on Wage Structure* was given by the Japanese Ministry of Health, Labour, and Welfare. This research was supported by the Japan Society for the Promotion of Science (JSPS) Grants-in-Aid for Scientific Research (C) (Grant numbers: 25380371 and 16K03711), the JSPS Fund for the Promotion of Joint International Research (Grant number: 15KK0097), and a research grant from the Japan Center for Economic Research. Editorial assistance was provided by Philip MacLellan.

1 Introduction

The gender gap in wages has long drawn the attention of labor economists, but recent advances in econometric methods, and a popular notion that there are "subtle barriers" in the labor market that are not captured by traditional measures, has led to an interest in building upon the extensive research on the gender gap at the mean to explore how and why the gender gap varies throughout the wage distribution.[1] The metaphors of the "glass ceiling" and "sticky floor" represent the presumed barriers that exist at the extremes of the female wage distribution that prevent some women from reaching the upper echelon in business, government, and academia, while keeping others in jobs with low wages. These metaphors imply that there might be invisible bottlenecks impeding the occupational advancement of women.

This notion runs counter to evidence of an encouraging decline in the gender gap in wages in recent decades. Japan has shown convergence since 1990, with the female-male ratio of average monthly scheduled wages of full-time workers rising from 59.7% to 72.2% in 2014.[2] However, this gap has now stabilized, and it remains at the second highest level among OECD countries after Korea.[3] What, then, impedes a further reduction? To address this question, this study examines the current gender gap in Japan across the

[1]Such studies include Fortin and Lemieux [1998] in the U.S.; Javdani [2015] in Canada; Arulampalam, Booth, and Bryan [2007] in Europe; Albrecht, Bjorklund, and Vroman [2003] in Sweden; and de la Rica, Dolado, and Llorens [2008] in Spain.

[2]Data source: The Japanese Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*. In the BSWS, such workers are called *ippan* workers.

[3]Source: The OECD database.

wage distribution as well as how the situation has changed over the last quarter-century.

One source of the gender wage gap in Japan is its characteristic human resource management (HRM) system that has been adopted by companies worldwide to promote employee participation and productivity in order to improve economic performance. The Japanese HRM model, known also as a kind of the "innovative HRM model" or "high performance work practices" in the literature, has attracted great interest from business leaders and researchers, as is explained in more detail in Section 2. The positive aspects of the Japanese HRM system have long been emphasized, and this is bolstered by the ample empirical evidence that it actually improves a company's productivity.

However, a dark side of the Japanese HRM model exists in that when companies introduce the system, gender segregation tends to take place. This occurs because the company expects, *ex ante*, a high probability for the female worker to leave because she has a better outside option, which is her higher value of household production as shown in Lazear and Rosen [1990]. Consequently, male workers are likely to be assigned to jobs with a career track and a large return to tenure while female workers are more likely to be assigned to non-career track jobs with little return to tenure. Such gender job segregation could cause the gender wage gap.

On the other hand, a small number of female workers of *very high ability* do get assigned to jobs with a career track like their male co-workers because female workers are assumed to have the same ability distribution as male workers. This situation has created a puzzle within the Lazear and Rosen model, however, because if only a few female workers with very high ability are assigned to jobs with a career track and a high return to tenure, then the average wage for female workers in high-paying jobs should be higher than it is for male workers, but this is not observed empirically. In the present study, we solve this puzzle.

In order to explore the nature of the gender gap in wages in Japan and its change over time, this study adopted a decomposition method for distributional statistics beyond the mean based on the recentered influence function (RIF) regression proposed by Firpo, Fortin, and Lemieux [2009] (hereafter, the FFL decomposition). While providing insight into the characteristics of the gender gap in wages throughout the distribution instead of just at the mean, the FFL decomposition is otherwise similar to the Oaxaca-Blinder (OB)-type decomposition at the mean in that it enables us to separate the observed gap into two parts: one part due to differences in human capital attributes such as education, tenure or experience in the labor market (the *compositional* effect), and another part that cannot be explained by these human capital attributes and so it instead represents gender-based differences in the returns to those attributes (the *wage structure* effect). We define the *glass ceiling* as the occasion in which the wage structure effect (that is, the unexplained part of the gender gap), is larger at the *top* of the wage distribution than in the middle range, and the *sticky floor* as a wage structure effect that is larger at the *bottom* of the distribution than in the middle range.

The contribution of this study is to build upon the work of Chiang and Ohtake [2014] and Kawaguchi [2005] to show the potential adverse gendering effects of Japanese high performance work practices that are typically viewed favorably due to their positive effects on economic performance. While Chiang and Ohtake [2014], following the Machado and Mata [2005] (MM) decomposition method, also examine the gender wage gap across the wage distribution, they focus on gender gap differences between two groups of workers (performance-pay and non-performance-pay), finding that a glass ceiling exists for white collar workers under a non-performance-based pay system. The study reported in this paper, by contrast, provides a comprehensive view of the gender gap across the wage distribution in Japan using the *Basic Survey on Wage Structure*, a large-sample dataset that provides the definitive governmental view of wages in Japan. Further, in our examination we use the sampling weight to make the analysis sample representative of the target population.

The most important results in this study are:

1. The raw gender wage gap has decreased throughout the wage distribution from 1990 to 2014, due in large part to a decrease in gender differences in human capital attributes during this period.
2. Larger wage structure effects (i.e. unexplained gender gaps) are observed at the bottom and top of the wage distribution than in the middle range throughout the period under study, indicating that both

the glass ceiling and sticky floor phenomena exist in the Japanese labor market and have since at least 1990.

3. The sticky floor phenomenon can be explained by the fact that female workers tend to be segregated into non-career track jobs that are rewarded neither by tenure nor firm-specific skills.
4. Female segregation occurs both into low-paying firms and into low-paying jobs within a firm.
5. An apparent contradiction exists at the top of the wage distribution, where a glass ceiling is observed but yet female workers are rewarded more than male workers by an additional year of tenure. However, this apparent contradiction can be resolved by considering differences in the quality (as opposed to length) of education between female and male workers.

2 Gender Gap and the Japanese High-Performance Work Practices

2.1 Previous Studies on Gender Wage Gap through the Wage Distribution

While the examination of the gender gap at the mean is interesting, it provides only a general indication of the wage outcomes of the "average" worker of each gender. Since Albrecht, Bjorklund, and Vroman [2003]'s seminal paper, there has been a growing number of studies on the gender gap throughout the wage distribution, which has provided a more comprehensive view of the gender gap and insight into sticky floor and glass ceiling phenomena that occur at the tails of the wage distribution.

Much of this research has been conducted outside Japan and has found that glass ceilings, sticky floors, or both are observed in many countries. In Sweden, Albrecht, Bjorklund, and Vroman [2003] find that the gender gap has been sharply increasing at the top of the distribution and conclude that a glass ceiling might exist, while Arulampalam, Booth, and Bryan [2007], examining eleven EU countries, show that female workers face a glass ceiling in most of them.[4] Both of these studies point out that the glass ceiling phenomenon may be related to family-friendly government policies which thereby provide a double-edged sword for women.

Other studies have shown that a gender gap exists throughout the wage distribution, including evidence of a sticky floor at the lower tail. For example, Chi and Li [2008] show that the gender gap across the wage distribution in urban China has increased, in contrast to that of the US, Sweden, and Japan where convergence has been observed, and they also find strong evidence of a sticky floor. Carrillo, Gandelman, and Robano [2014], in their study of twelve Latin American countries, find glass ceilings in some countries, sticky floors in others, and both phenomena in still others.[5] They also

[4]These include Austria, Belgium, Great Britain, Denmark, Finland, France and Germany, while in Ireland, neither a glass ceiling nor a sticky floor is observed.

[5]The glass ceiling is observed in Argentina, Brazil, Paraguay, and Uruguay, the sticky floor is in Bolivia, Chile and Peru, and both the glass ceiling and the sticky floor are observed in Colombia, Costa Rica, Honduras, Mexico, and Venezuela.

show that glass ceilings are more likely to occur in countries with high economic growth, whereas sticky floors tend to prevail in countries with low economic growth. In terms of worker characteristics, de la Rica, Dolado, and Llorens [2008] show that in Spain the glass ceiling phenomenon is observed for highly educated workers, but for less-educated workers, the gender gap is quite large at the lower range of the wage distribution, but it decreases

at the upper range which they call a *floor* pattern. They further suggest that the statistical discrimination of less-educated women by employers reduces firm-specific training and, as a result, causes a lower wage.

The literature thus shows that the size and specific location of a gender gap within the wage distribution varies according to country, and while there is an extensive body of research on the gender wage gap in Japan, it has focused mainly on gender differences in conditional mean wages after controlling for observable characteristics related to the productivity of employees and the wage structure (Kawaguchi [2005] and Miyoshi [2008]). This traditional 'decomposition at the mean' methodology illuminates the conditions faced only by the 'average' worker. To my knowledge, Chiang and Ohtake [2014] is the only examination to date of the gender gap across the wage distribution in Japan, but they use a unique small-sample data set that does not clarify the overall work environment in Japan. Therefore, the current study that draws upon Japan's large-sample Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure* to estimate the gender wage gap across the wage distribution provides the first comprehensive and representative view of the topic in Japan.

2.2 Gender Wage Gap and the Japanese HRM system

In terms of Japan, some studies such as Kawaguchi [2015] and Chiang and Ohtake [2014] have shown empirically that the human resource management system in the Japanese labor market creates a gender wage gap.[6] Theoretical support for these findings is provided by Lazear and Rosen [1990]'s *"jobs" theory of discrimination*, which describes the Japanese labor market well and predicts that if a clear-cut gender-based distinction exists in either the assignment of jobs or in promotion opportunities, a gender gap in wages is likely to appear.

The model assumes that there are two jobs, A and B. Job A requires investment by the firm in the form of firm-specific training and so an initial period of low worker productivity is followed by one of high productivity, with the worker in job A receiving a low wage initially, followed by a very high wage. Job B, on the other hand, does not require training and so a worker's productivity remains constant and the worker thus earns a modest wage in both the initial and the later periods.

Meanwhile, the firm also knows that a female worker has better outside

[6] Kawaguchi [2015] shows that establishments operating a lifetime employment system, seniority wage system, or internal promotion system are likely to have large gender wage gaps and this, together with the Chiang and Ohtake [2014] study mentioned above that finds a glass ceiling effect for workers under a non-performance-based pay system, suggests that the Japanese HRM system is likely to impede gender pay equity. Yamaguchi [2009] and Osawa [2015] also discuss this issue.

opportunities (in household production, for example) than a male worker, and therefore expects a female worker to more likely leave the firm before the third period. Accordingly, the firm will avoid allocating a female worker to job A, which requires initial investment in return for a more productive worker later, and instead will likely allocate her to job B, even if she has the same ability as a male worker. This model suggests a means through which a gender wage gap can be produced through the allocation of jobs, with job A considered to have a high firm-specific job value and job B a low value. In this study, we show that features of the model that also exist in the Japanese human resource management (HRM) system play a major role in producing subtle gender barriers in Japan.

The Japanese HRM system is another well-researched area of labor economics, as briefly mentioned in Section 1. Many theoretical models have shown its effectiveness and economic rationality (Lazear [1979], Itoh [1994], Aoki [1988], and Kandel and Lazear [1992]), and it has been shown empirically that such a system promotes high worker productivity (Ichniowski, Shaw, and Prennushi [1997]). According to Moriguchi [2014], the system is based on the premise of harmonious labor relations and, at its core, relies on a tacit agreement in which a firm ensures *implicit* employment security in order to encourage employees to accumulate firm-specific human capital, as well as a seniority system that is applied to all regular employees, both white-collar and blue-collar. Not all employees work under this system, however, and the majority of those who do are typically men. To put it plainly, male workers are more likely to be assigned to career track jobs within a firm, while female workers are likely to be assigned to non-career track jobs.

This traditional labor practice can be traced to before the Equal Employment Opportunities Law (EEOL) was enacted in 1986. Before this, Japanese firms typically introduced a gendered employment management system whereby male workers were assigned to jobs with a career track within a company, while female workers were assigned to non-career track jobs.[7] With the enactment of EEOL, such a "literal" gendered management system became illegal, so Japanese firms instead began to introduce the new *Career Track-based Employment Management System* (*kousu-betsu-koyou-kanri-seido*), a two-track system consisting of a career-oriented management track and a non-career-oriented clerical track. Under this new system, larger firms in administering their personnel systems often take the job category as the decision unit, establishing pay rates for each category and linking jobs in each track into promotion ladders. However, this current multi-track system is in practice virtually the same as the earlier explicitly gendered employment management system.[8] Further, while each track is ostensibly open to either gender, men are overwhelming assigned to career track jobs while only

[7]This paragraph is based on "Points of Concern about the Career Track-based Employment Management System" by the Japanese Ministry of Health, Labour, and Welfare (http://www.mhlw.go.jp/general/seido/koyou/danjokintou/dl/koyoukanri-a01.pdf).

[8]Among companies that have introduced the Career Track-Based Employment Management System, 66.4% have also introduced a system allowing a worker to convert from a non-career-oriented clerical track to a career-oriented management track (The Japanese Ministry of Health, Labour, and Welfare *Basic Survey of Gender Equality in Employment Management*), but the number of workers who actually convert is thought to be quite small.

a small number of women are, the majority being assigned instead to non-career track jobs (though this may be partially caused by self-selection).[9] In Japan, then, one of the causes of the gender wage gap might be that women are being channeled into different job categories than men. In the following sections, we explore whether this hypothesis is supported empirically.

Lastly, some research has shown that the gender wage gap could also be caused by the allocation of female workers into low-paying firms/establishments (Bayard, Hellerstein, Neumark, and Troske [2003], Carrington and Troske [1998]). Using Canadian data, Javdani [2015] applies a method developed by Pendakur and Woodcock [2010] to explore the cause of this phenomenon through the wage distribution and finds clear evidence that women experience a glass ceiling that is driven not primarily by their experiences within a firm but, rather, by their disproportionate sorting across firms. In Section 5, we also examine this phenomenon and the extent to which the gender gap may be caused by allocation of women into low-paying jobs across establishments, as opposed to the subtle barriers to advancement women experience within an establishment (Section 5.3).

[9] Among new employees in 2014, the female ratio of those in the career-oriented management track and non-career-oriented tracks were 22.2% and 82.1%, respectively (The Japanese Ministry of Health, Labour, and Welfare, http://www.mhlw.go.jp/stf/houdou/0000089473.html).

3 Data

3.1 Analysis Sample and Variables

This study utilizes micro data for 1990, 2000, and 2014 from the *Basic Survey on Wage Structure* (BSWS) conducted by the Japanese Ministry of Health, Labour, and Welfare (MHLW). The BSWS is a fundamental governmental statistical database that provides the most reliable data on employee wages in the country, with information on all major industries.[10] The survey was initiated in 1948 and through its various revisions has been carried out every year since then, surveying establishments and employees that are both selected through a uniform sampling method. The establishment survey covers establishments with more than five employees and the employee survey covers the employees working in those selected establishments. For this study, we have been permitted by the MHLW to use BSWS data from 1990.

Here we describe how the analysis sample was formed. First, the sample was restricted to full-time (*ippan*, in Japanese) workers, because the BSWS surveys the academic background of full-time workers but not of part-time workers. Full-time workers include both regular and non-regular workers,

[10] 1) Mining and Quarrying of Stone and Gravel; 2) Construction; 3) Manufacturing; 4) Electricity, Gas, Heating, and Water; 5) Information and Communications; 6) Transportation and Postal Services; 7) Wholesale and Retail Trade; 8) Finance and Insurance; 9) Real Estate and Goods Rental and Leasing; 13) Scientific Research, Professional and Technical Services; 11) Accommodations, Eating and Drinking Services; 12) Living-Related and Personal Services and Amusement Services; 13) Education and Learning Support; 14) Medical, Health Care, and Welfare; 15) Compound Services; and 16) Services (not classified elsewhere).

but the latter does not include temporary workers such as day laborers.[11] Additionally, the sample was restricted to those who were under 60 years old because many Japanese companies have introduced a mandatory retirement system that could make the wage determination system different for those who are younger than 60 and those who are older. Finally, the hourly wage was calculated as (monthly scheduled wage + bonus per month) ÷ (monthly scheduled hours) and because bonus details are surveyed only for workers whose length of the service is more than one year, the analysis sample was further restricted to those employees working for more than one year at that location.[12]

3.2 Descriptive Analysis

Next, we briefly describe the raw gender wage gap salient in our dataset. Firstly, as the BSWS adopts a two-stage sampling procedure,[13] we used the BSWS sample weights to weight back the data used in our estimation to create an analysis sample representative of the target population.[14] Figure

[11]Regular workers and non-regular workers in the *BSWS* includes employees hired (1) for an indefinite period, (2) for longer than one month, or (3) for less than one month or by the day and who were hired for 18 days or more in the past two months before the date of the survey (April and May).

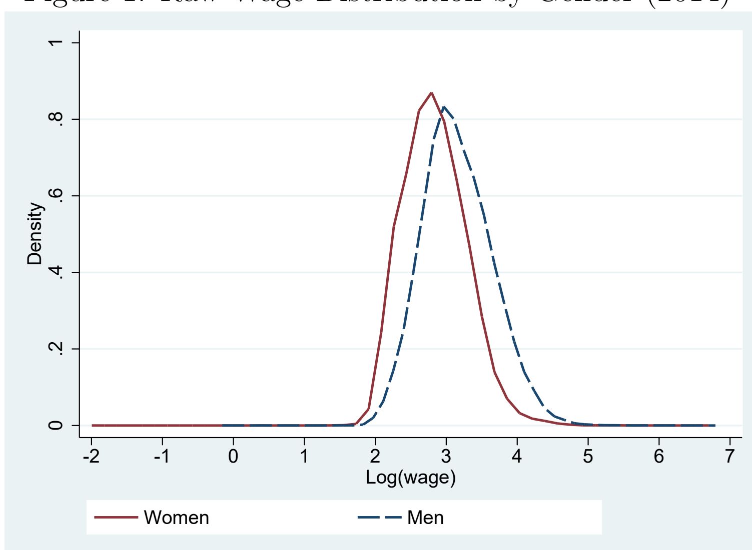
[12]We also excluded outliers, which were defined as samples for which the hourly wage was larger than 100,000 yen, and the number excluded was four.

[13]In the first stage, establishments are chosen for the survey with a probability of proportional representation for prefecture, industry, and establishment size. In the second stage, surveyed employees are chosen randomly, but the target number of respondents are decided by industry and establishment size.

[14]The probability of sampling a given observation j for the establishment survey, $1/\omega_j$, depends on prefecture, industry, and establishment size. This probability is the inverse of the sample weight (ω_j). In terms of the employee survey, the probability of sampling, $1/\omega_i$,

1 presents the raw log hourly wage distributions by gender in 2014. The wage distribution for females is located to the left of that for males and is thicker at the lower tail, implying that a higher proportion of female workers receive a low pay compared to male workers. In contrast, the distribution of male wages is thicker at the upper part than of females, meaning that women receive lower wages than men even in high-paying jobs.

Figure 1: Raw Wage Distribution by Gender (2014)



Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.

Figure 2 shows the gender wage gap (as defined by the difference in the log of wages between men and women) from the 5th percentile (P5) to the 90th percentile (P90), illustrating the wage differential between genders at each percentile. It shows that while the raw gender wage gap has decreased

depends on both the industry and establishment size for those working at an establishment with more than 500 employees and only on establishment size for those at establishments with less than 499 employees.

since 1990 at every percentile, the slope has increased over time at the higher end of the wage distribution. This indicates that a greater gap has emerged over time at the top of the distribution. Table 1 summarizes this information, providing information on the raw gender wage gap between P10 – P90, P10 – P50, and P50 – P90.

Focusing first on 2014, the most recent data, we see that: (1) The difference between P90 and P10 was 12 percentage points, which means that the raw gender wage gap was substantially larger at the top of the distribution than at the bottom, and (2) The difference between P90 and P50 (9 points) was slightly larger than that between P50 and P10 (3 points), implying that there is more growth in the raw gender wage gap at the upper than lower half of the distribution. We will discuss the years 1990, and 2000 later in the paper.

Table 1: Raw Gender Wage Gap by Selected Percentile Ranges (1990, 2000, 2014)

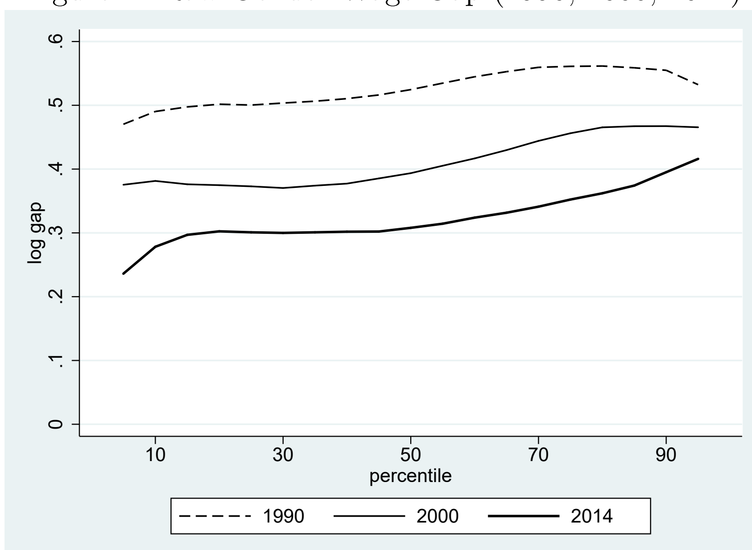
	P10 - P90	P10 - P50	P50 - P90
1990	0.06	0.03	0.03
2000	0.09	0.01	0.08
2014	0.12	0.03	0.09

Source: Ministry of Health, Labour, and Welfare, *Basic Survey on Wage Structure*.
Note:

1. Raw gender wage gap at each τ percentile is calculated by $Q_\tau[lnw_m] - Q_\tau[lnw_f]$.

Table 2 reports the summary statistics for both female and male workers. Age, tenure, potential experience, and the ratio of those who graduated from university or graduate school is larger for males than for females, and

Figure 2: Raw Gender Wage Gap (1990, 2000, 2014)



Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.
Note:

1. Raw gender wage gap at each τ percentile is calculated by $Q_\tau[lnw_m] - Q_\tau[lnw_f]$.

these differences in the quantity of human capital by themselves potentially contribute to the observed gender wage gap. Additionally, it is shown that the average ratio of those who are in a higher employment position such as section manager or director is larger for males than for females. Further, while the ratio of employees who work at small firms (less than 99 employees) is almost the same for males and females, it is greater for males at large companies (more than 1,000 employees) and larger for females at medium-size firms (100–999 employees). We can also observe gender differences by industry and occupation.

4 Econometric Strategy

4.1 Basic Regression Model: Human Capital Earnings Function

As with many empirical studies of wage determination, this study applies Mincer's well-known human capital earnings function (Mincer [1974]). For individual i, we performed an OLS estimation on the following regression equation:

$$lnw_i = \alpha + X_i\beta + e_i, \tag{1}$$

where lnw is the log hourly wage; α is a constant; X is a vector of human capital variables including years of schooling,[15] years of tenure and its square,

[15] 1) Junior high school: 9 years, 2) high school: 12 years, 3) two-year college/specialized vocational high school: 14 years, 4) university/graduate school: 16 years.

Table 2: Summary Statistics: BSWS, 2014

	Female		Male	
	Mean	SE	Mean	SE
ln hourlywage	2.844	2.844	3.132	0.001
Age	40.465	40.465	42.469	0.029
Tenure	9.773	9.773	13.827	0.028
Potential experience	21.916	21.916	23.853	0.030
Academic background				
Junior high school	0.019	0.001	0.039	0.001
High school	0.416	0.002	0.471	0.001
Two-year college/specialized vocational high school	0.326	0.002	0.115	0.001
University/graduate school	0.239	0.002	0.376	0.001
Position				
Ordinary worker	0.874	0.002	0.608	0.002
Foreman	0.003	0.000	0.032	0.001
Chief	0.043	0.001	0.098	0.001
Section manager	0.027	0.001	0.120	0.001
Director	0.007	0.000	0.047	0.001
Others	0.045	0.001	0.095	0.001
Firm size				
5–9	0.044	0.001	0.043	0.001
10–29	0.103	0.001	0.105	0.001
30–99	0.165	0.001	0.161	0.001
100–299	0.196	0.002	0.173	0.001
300–499	0.081	0.001	0.070	0.001
500–999	0.102	0.002	0.093	0.001
1000-4999	0.153	0.001	0.173	0.001
5000–	0.156	0.001	0.182	0.001
Industry				
Construction	0.027	0.001	0.096	0.001
Manufacturing	0.175	0.001	0.299	0.001
Electricity, gas, heat supply and water	0.003	0.000	0.012	0.000
Information and communications	0.033	0.001	0.054	0.001
Transport and postal activities	0.030	0.001	0.105	0.001
Wholesale and retail trade	0.135	0.001	0.145	0.001
Finance and insurance	0.064	0.001	0.031	0.000
Real estate and goods rental and leasing	0.012	0.000	0.013	0.000
Scientific research, professional and technical services	0.026	0.001	0.033	0.000
Accommodations, eating and drinking services	0.025	0.000	0.020	0.000
Living-related and personal services and amusement services	0.027	0.000	0.017	0.000
Education, learning support	0.037	0.000	0.024	0.000
Medical, health care and welfare	0.335	0.002	0.058	0.001
Compound services	0.014	0.000	0.024	0.000
The other services	0.057	0.001	0.068	0.001

Source: Ministry of Health, Labour, and Welfare, *Basic Survey on Wage Structure.*

and years of potential labor market experience and its square; and e is an error term. The years of potential labor market experience is the work experience an employee would have if they had worked continuously with their age cohort, and is calculated as [age – years of schooling – 6 + 1].[16]

Next, we describe the regression equation for estimating factors of wage determination within an establishment. To control for any establishment fixed effect, we applied the method proposed by Mundlak [1978], which means that we included the establishment means of the human capital variables, $\bar{X}_j$, in Eq. (1), where j indicates an establishment. The regression equation is

$$lnw_i = \alpha + X_i\beta + \bar{X}_j\gamma + e_i, \tag{2}$$

and by performing the OLS estimation, we obtained the $\hat{\beta}$s, which are the same coefficients obtained when performing the fixed effect estimation (see Mundlak [1978]).

4.2 Decomposing the wage distribution: The FFL decomposition

Next, we made use of a RIF-regression method proposed in Firpo, Fortin, and Lemieux [2009] (FFL) to decompose the observed gender wage gap at each quantile into two parts: one that results from compositional effects (those explained by gender differences in human capital) and one that results from wage structure effects (those not explained by differences in human capital

[16] In Japan, the enrollment age for elementary school is 6 years old.

and therefore due to differences in the returns to that human capital). We then performed a detailed decomposition to assess the role played by key explanatory variables in both the compositional and the wage structure effects. Among the recent approaches for computing a decomposition for distributional statistics beyond the mean (Machado and Mata [2005], Firpo, Fortin, and Lemieux (2009)), the FFL method has several advantages, including a computation that is not intensive and that allows us to perform a detailed decomposition in terms of both the composition and the wage structure effects. In this section, the FFL decomposition method is described briefly.

The FFL decomposition is essentially the same as the usual Oaxaca-Blinder (OB) technique except that rather than only identifying the sources of the differences between the means of two distributions, this decomposition allows us to explain the differences between the male and female log wage distributions quantile by quantile. The FFL decomposition technique rests on using the recentered influence function (RIF) as the dependent variable in a linear regression framework. For quantile Q_τ, the RIF for observation w_i is given by

$$RIF(w_i; Q_\tau) = Q_\tau + \frac{\tau - 1[w_i \leq Q_\tau]}{f_w(Q_\tau)}, \tag{3}$$

where $f_w(\cdot)$ is the density and $1(\cdot)$ is the indicator as to whether the wage observation is at or below quantile Q_τ. The idea behind recentering the RIF by adding Q_τ is simply that since $E(\tau - 1[w_i \leq Q_\tau]) = 0$, the expected value of the recentered RIF will be Q_τ itself. Firpo, Fortin, and Lemieux [2009] show that this property also extends to the conditional-on-X RIF.

To perform the FFL decomposition, the RIF regression was first run at each quantile on Eq.(1), and then the usual OB decomposition was performed. The procedure is as follows:

(1) Compute the RIF for each quantile τ of interest by gender ($R\hat{I}F(w_{i,g}; Q_{\tau,g})$, where $g = female, male$).
(2) Run an OLS regression of the RIF on the vector of covariates (X_i) by gender, and estimate the following regression equation:

$$R\hat{I}F(ln(w_{i,g}); Q_{\tau,g}) = \alpha_{\tau,g} + \beta_{\tau,g} X_{i,g} + u_{i,g}, \tag{4}$$

(3) Perform the usual OB decomposition.

The coefficients of the RIF regressions for each gender, $\hat{\beta}_{\tau,g}$, are expressed as

$$\hat{\beta}_{\tau,g} = (\sum_{i \in g} X_i X_i')^{-1} \sum_{i \in g} R\hat{I}F(ln(w_{i,g}); Q_{\tau,g}) X_i. \tag{5}$$

The gender log wage gap at each quantile is $\Delta_\tau = Q_\tau[ln(w_m)] - Q_\tau[ln(w_f)]$, and we can write the estimated gender wage gap as follows,[17] using $\hat{\beta}_{\tau,g}$, which is equivalent to the OB decomposition for any unconditional quantile, as

[17] The FFL decomposition procedure is based on providing a linear approximation of a nonlinear function of the distribution and thus provides only a first-order approximation of the true effects irrespective of whether or not one uses a linear probability model. Therefore, the extent to which the approximation is imperfect, including the choice of linear probability model, will be reflected in the approximation error.

$$\begin{aligned}
\hat{\Delta_\tau} &= E[RIF_\tau[ln(w_m)]] - E[RIF_\tau[ln(w_f)]] && (6)\\
&= \bar{X}_m\hat{\beta}_{m,\tau} - \bar{X}_f\hat{\beta}_{f,\tau} && (7)\\
&= \underbrace{(\bar{X}_m - \bar{X}_f)\hat{\beta}_{f,\tau}}_{composition\ effect} + \underbrace{\bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})}_{wage\ structure\ effect} && (8)\\
&= \hat{\Delta_X^\tau} + \hat{\Delta_S^\tau}. && (9)
\end{aligned}$$

The first term in Eq. (8) can be rewritten in terms of the sum of the contribution of each covariate as

$$\hat{\Delta_X^\tau} = \sum_{k=1}^{K}(\bar{X}_{mk} - \bar{X}_{fk})\hat{\beta}_{fk,\tau}, \quad k = 1, \ldots, K, \tag{10}$$

and the second term as the sum of the difference of the return of each covariate, as

$$\hat{\Delta_S^\tau} = \sum_{k=1}^{K}\bar{X}_{mk}(\hat{\beta}_{mk,\tau} - \hat{\beta}_{fk,\tau}), \quad k = 1, \ldots, K. \tag{11}$$

Through these equations, we could compute the composition and wage structure effects.[18]

5 Results: Recent Situation

5.1 Subtle Barriers across Establishments

Here we show the results of the FFL decomposition of the gender gap in the log of wages outlined in Section 4 using Eq. (1), which means that the results

[18]See Fortin, Lemieux, and Firpo [2011] for detail.

reported here represent the gender gap across establishments that is caused by differences both in the choice of the establishment where an employee works and of job allocation within a given establishment. Figure 3 presents the estimated raw gender wage gaps ($E[RIF_\tau[lnw_m]] - E[RIF_\tau[lnw_f]]$) and the wage structure effects within the gender wage gaps ($\bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$) at every fifth percentile between P5 and P95. Recall that wage structure effects represent the portion of the gender wage gap that is unexplained by human capital attributes; that is, the gap in wages that is observed because female workers are paid according to their own wage structure even though they possess the same human capital as men. The difference between the estimated raw gender gaps and the wage structure effects are the composition effects, the portion of the wage gap that is explained by differences in human capital. As the estimated raw gap here is broadly the same as the raw gap reported in Figure 2, any approximation error appears to be quite small.[19]

However, we also see in Figure 3 that the wage structure effects are smaller toward the middle of the distribution but become larger toward the top. Specifically, we notice first that these effects are larger in the upper range of the distribution (above P65) than at the median (P50). Further, although the effect is not to the extent that Albrecht, Bjorklund, and Vroman [2003] report in Sweden, we also see a sharp acceleration of the gap in the upper range, with the gender gap at P95 exceeding that of P50 by more than 10 points. Therefore, in high-paying jobs, the unexplained gender gap becomes

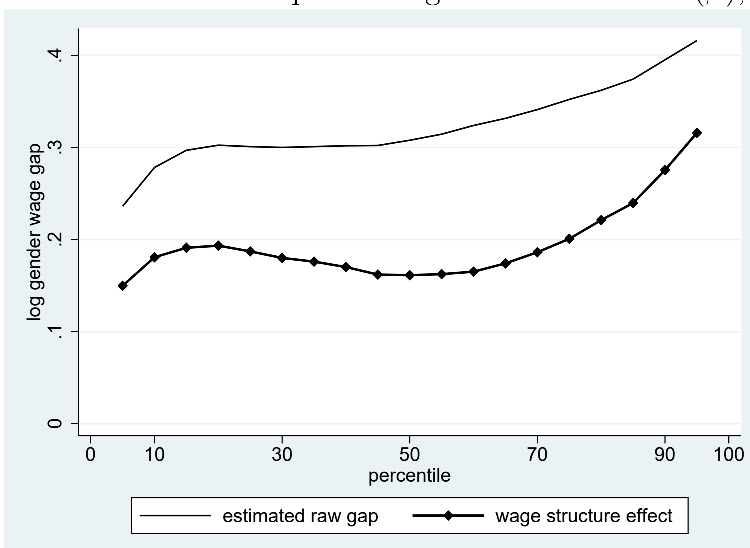
[19]Selected results of the raw gap and the estimated gap are reported in Table 3.

increasingly large as the wage increases, an indication of the glass ceiling phenomenon.

Additionally, we see that the wage structure effects are also larger between P10 and P45 in the lower range of the distribution than at the median, with the gender gap at P15 exceeding that of P50 by about 3 points,[20] and while this difference is less than at the upper range of the distribution, these unexplained gender gaps among low wage jobs are signs of a sticky floor. These results thus suggest that there exists both a glass ceiling and a weak sticky floor in Japan.

[20]This study follows Arulampalam, Booth, and Bryan [2007] who define a glass ceiling/sticky floor as a gender gap of more than 2 points at the top/bottom of the wage distribution.

Figure 3: Raw Gender Gap and Wage Structure Effect ($\hat{\beta}$), 2014



Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.
Notes:

1. Estimated raw gender gap = $E[RIF_\tau[lnw_m]] - E[RIF_\tau[lnw_f]]$, and wage structure effect = $\bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$.
2. All estimation results are 1% statistically significant.

5.2 Gender Differentials of the Wage Structure: Detailed Decomposition

Next, in order to identify the specific factors that lead to the gender gap in Japan, we show in Table 3 the results of the detailed decomposition for the composition and the wage structure effects at P10, P50, and P90, following Eq. (10) and Eq. (11).[21]

We can see in Panel C that the composition effects are largely driven by tenure at each percentile. Meanwhile, focusing on the wage structure effects in Panel D, we can see that the difference in the return to tenure is also high at the bottom of the wage distribution, with the return less for female workers than males. This implies that in the lower range of the wage distribution there may be many female workers who engage in jobs that are neither evaluated nor rewarded by tenure. However, this difference declines as we move up the distribution and turns negative in the upper range, which means that women actually receive a large additional return to tenure at the top of the wage distribution when compared to men. This corresponds to the relatively few high ability female workers in the Lazear and Rosen [1990] model who manage to advance their careers in career-track Job A. However, we simultaneously observe a large difference in the return to educational years at the top of the distribution, which could be the cause of the large gender wage gap there. Specifically, this large difference in the returns to

[21] The tenure and its squared, and the potential experience and its squared are bundled respectively.

educational years could result from unmeasured ability, one dimension of which being that female workers receive a different quality of education than male workers. We next discuss the tenure results in more detail as it applies to Japan.

Table 3: Results of Detailed Decomposition, 2014

	P10		P50		P90	
A. Raw log wage gap						
$Q_t[lnw_m] - Q_t[lnw_f]$	0.278	(0.003)	0.308	(0.003)	0.395	(0.004)
B. Estimated wage gap						
$E[RIF_t[lnw_m]] - E[RIF_t[lnw_f]]$	0.253	(0.002)	0.298	(0.003)	0.390	(0.004)
C. Composition effects attributable to						
Tenure	0.087	(0.001)	0.115	(0.001)	0.076	(0.001)
Potential exp	-0.001	(0.001)	0.021	(0.001)	0.030	(0.001)
Education	0.005	(0.001)	0.007	(0.001)	0.010	(0.001)
Total	0.091	(0.001)	0.143	(0.002)	0.116	(0.002)
D. Wage structure effects attributable to						
Tenure	0.165	(0.006)	0.032	(0.005)	-0.099	(0.008)
Potential exp	0.072	(0.012)	0.209	(0.010)	0.101	(0.012)
Education	-0.030	(0.020)	-0.297	(0.020)	0.193	(0.035)
Constant	-0.045	(0.025)	0.211	(0.022)	0.078	(0.040)
Total	0.162	(0.003)	0.155	(0.003)	0.273	(0.004)

Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.
Notes:

1. The wage structure effect $= \bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$, and the composition effect $= (\bar{X}_m - \bar{X}_f)\hat{\beta}_{f,\tau}$.
2. Bootstrapped standard errors are in parentheses, and the number of reps was 100.

In Japan, there are three possible means by which jobs might be allocated by gender; that is, with female workers more likely to be induced to take jobs requiring fewer firm-specific skills. First, more than half of female employees in Japan are non-regular workers,[22] and those who work full-time were thus included in our analysis sample. One reason for this high proportion of non-regular female workers is that approximately 30% of women in Japan quit their jobs after giving birth to their first child.[23] When they re-enter the labor market after raising their children, most then become non-regular workers with a non-career track job category.

Second, even among regular workers, Schwartz [1989] notes that certain female employees might be on the so-called "mommy track," which impedes the upward mobility of female workers beyond the middle levels. As these kinds of jobs are actually non-career track, experience at the workplace and in the labor market generally are not likely to be rewarded.[24]

Third, it is possible for even full-time regular female workers to be allocated into lower-paying jobs requiring fewer firm-specfic skills. As described in Section 2, some Japanese firms (most of these among Japan's largest companies), have introduced a dual-track employment management system (*kousu-betsu-koyou-kanri-seido*) that allocates full-time regular workers into either a career track (*sogo-syoku*) or non-career track (*ippan-syoku*) position. However, according to a survey by the Japanese Ministry of Health, Labour,

[22] According to the *Labor Force Survey* conducted by the Japanese Bureau of Statistics, 56.7% of Japanese female employees were non-regular workers in 2014.

[23] The Japanese National Institute of Population and Social Security Research *National Fertility Survey*.

[24] It should be noted, though, that there might exist a countervailing endogeneity to tenure, because better matching might cause longer tenure, resulting in higher wages.

and Welfare, men comprised the majority of workers in jobs with a career track while the majority of non-career track workers were women.[25]. This indicates that despite an ostensibly gender-neutral dual track HRM system, in practice, male workers are systematically allocated to positions with a career track and female workers to those with a non-career track.

This is important because a position on the career track has a high career ladder and a steeper wage profile over time, while the non-career track wage profile is flatter and the ceiling is lower. The decision as to which track an employee is assigned occurs when she/he is hired, and the number of women who are initially assigned to a career track position with a steep wage profile are relatively few. Further, only a small number of employees manage to switch tracks mid-career, so the many female workers who are initially assigned to low wage profile non-career track positions are likely to remain in jobs with low-pay for the remainder of their working lives. In this way, the employment management category system perpetuates the allocation of male and female workers into different jobs.

If the above argument is true, one would expect the phenomenon to be most salient in large firms, where the adoption of the dual-track management system has been highest. Table A1 reports the estimated gender wage gap and detailed decomposition results by firm size, with large firms con-

[25] In the 2012 *Basic Survey of Gender Equality in Employment Management*, of the companies surveyed that had introduced the dual-track employment management category system, 72.0% responded that the majority of employees in the core category were men, while 59.2% responded that the majority of workers in the subsidiary category were women.

sisting of those with more than 1,000 employees and small firms having less than 100 employees. In large firms, substantial wage structure effects are observed both at P10 and P90, and the return to tenure for female workers is larger than that for male workers at P90. However, as this phenomenon does not exist to such an extent in small firms, the evidence supports the above argument.

Finally, before we leave this section, we want to consider not only the gendered wage effects accruing from actual employment but also those that might accrue from life decisions that may have taken women out of the labor market, so next we look at the estimates of the potential experience variable. These show a different pattern than that of tenure, with the gender gap rising in the middle of the wage distribution before declining in the upper range. This is not surprising, as in the middle of the distribution, the potential experience of many women (that is, their years of work if they had remained in the labor force with their age cohort) is very different from their *actual* experience, due to such life events and decisions as childbirth, childcare, eldercare, and household production. The actual years of experience thus tend to be quite different between men and women, although the potential experience profile suggests that women at the very top of the wage distribution can overcome any difference that might exist in potential experience.

An alternative interpretation is that the substantial difference in the actual work experience of men and women might induce a difference in the quality of experience in the middle range of the wage distribution that is not picked up by estimates of the composition effect and is thus attributed to wage structure effects. One would expect the quality of experience in the very best jobs to be similar, however, and this would reduce any estimation error at the top of the wage distribution, thus causing the estimated gender gap in the return to potential experience to decrease at the top of the range.

5.3 Subtle Barriers Within an Establishment

In addition to a gender wage gap being created by the segregation of women into low-paying firms as described in Section 5.1, the gender gap could also be due to the segregation of women into low-paying jobs within the firm. In order to see how the results above might change if employees were all working at the same workplace, we controlled for establishment fixed effects using the Mundlak method (Eq. (2)) before performing the FFL decomposition. As explained in Section 4, this estimation controls for heterogeneity in the establishments where employees work and so the estimation results can be interpreted as the wage difference between male and female employees who work at the same establishment. Here, we restricted the analysis sample to full-time workers at only those establishments that employed both female and male workers.[26]

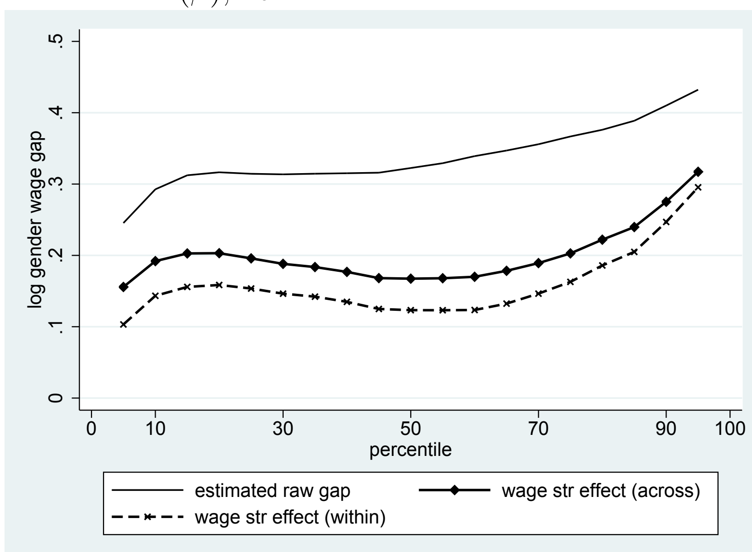
Figure 4 presents the results after controlling for the establishment fixed effect. As this analysis sample was different from that of Figure 3, we also re-

[26]In this restricted sample, the average number of workers per establishment was 17.5, with the minimum 2 and maximum 263. The average proportion of female workers was 34.4%.

estimated the raw gender gap and wage structure effect for the new analysis sample without controlling for the establishment effects, and these are also presented in Figure 4 for comparison, and we can see that there is not quite a difference between them.

Of interest here is the wage structure effect within an establishment and we see that after controlling for the establishment fixed effect, the gender gap at each percentile was reduced, indicating that throughout the wage distribution, a portion of the gender wage gap was caused by *that women are likely to be hired by low-paying firms.* In other words, the gender wage gap is still remained even after controlling for the establishment fixed effects. In comparison across the wage distribution, the wage structure effect within an establishment is much smaller than that across establishments at the lower tail, but when we move to the upper tail, the difference between that within an establishment and that across establishments becomes smaller, which implies that the gender gap in high-paying jobs is more likely due to segregation into relatively lower paying jobs *within a single establishment.*

Figure 4: Across- and Within-Establishment Gender Gap Caused by the Wage Structure Effect ($\hat{\beta}$), 2014



Source: Ministry of Health, Labour, and Welfare, *Basic Survey on Wage Structure*.
Notes:

1. "Estimated raw gender gap" $= E[RIF_\tau[lnw_m]] - E[RIF_\tau[lnw_f]]$, and "wage structure effect" $= \bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$.
2. "Across" is estimated using Eq. (1) and indicates the gender gap across establishments; "Within" is estimated using Eq. (2) and indicates the gender gap within an establishment.
3. The analysis sample is full-time workers at establishments employing both female and male workers.
4. F tests performed at each percentile to test the null hypothesis that $\gamma = 0$ in Equation (2) for both the composition and the wage structure effects were all rejected at the 1 % significance level.

5.4 Effects of Gender Differentials of Promotion

One possible cause of the large observed gender gap at the upper range of the wage distribution might be gender differences in promotion, and we explore that now. As this effect could entail promotion within or across firms, we return to examining the gender gap *across establishments* (in contrast to the within-establishment analysis of the immediately preceding subsection). As the BSWS survey includes data on employment position such as director or section manager only for employees working at establishments with more than 100 employees, we restricted our analysis sample to these establishments for this FFL decomposition.

First, in order to examine the effect of this sample restriction on the analysis, we began by re-estimating Eq. (1) to determine the wage structure effect when not controlling for employment position. Comparing these results presented in Figures 3 and 5, we can see that the shapes are similar but the estimated wage gap in Figure 5 is slightly larger at all quantiles, suggesting that the gender wage gap might be greater in large establishments with more than 100 employees than in small ones.

Next, we discuss the results after controlling for employment position.[27] We can see that the compositional effects are larger and the wage structure effects smaller than when we did not control for position. However, the wage structure effects remain positive at both the bottom and the top of the dis-

[27] We constructed the dummy variables from the following categories; 1) director (*bucho*); 2) section manager (*kacho*); 3) chief (*kakaricho*); 4) foreman (*syokucho*); and 5) others.

tribution while almost disappearing around the median. These findings are thus consistent with Kato, Kawaguchi, and Owan [2013] who, using company personnel data, show that no statistically significant gender wage gap is observed at the mean after controlling for employment position.

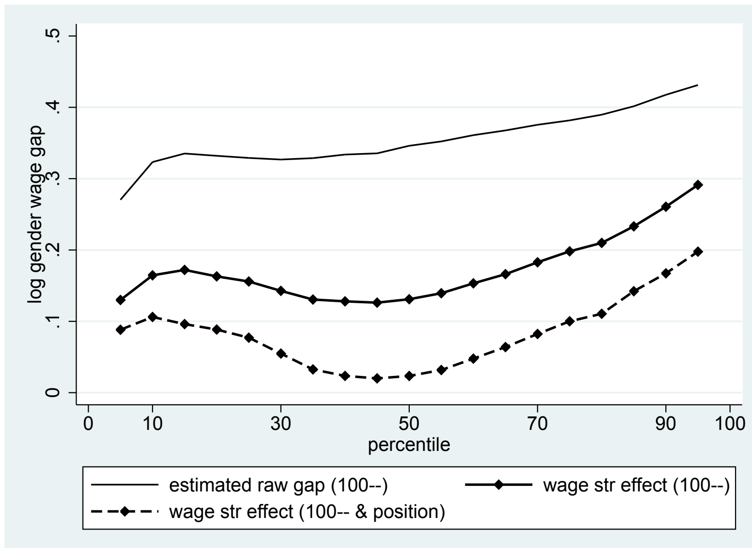
This disappearance of the wage structure effect around the middle of the distribution when employment position was controlled for indicates that most of the raw gender gap at the mean is explained by differences in human capital and employment position. However, at the upper range of the wage distribution, this does not hold, as even after controlling for employment position, a large gender gap was observed, suggesting that if a female worker gets promoted a job rank, she will tend to remain stuck at the bottom of the wage scale for the new employment position, an idea suggested by Booth, Francesconi, and Frank [2003], or she will be assigned to a less important position among the same job rank.

6 Results: Time-series Comparison

In addition to estimating the gender wage gap for 2014, our most recent date, we also examined changes in the gender wage gap in Japan from 1990 to 2014, and these results are discussed here. Figure 6 shows the estimated total gender wage gap and the wage structure effects in 1990, 2000, and 2014, and we can see that the *raw* gender wage gap has decreased since 1990 throughout the wage distribution.

We also notice from Figure 6 that the wage structure effect appears to

Figure 5: FFL Decomposition Results Controlling for Employment Position, 2014)



Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.
Notes:

1. Dataset restricted to firms employing more than 100 workers.

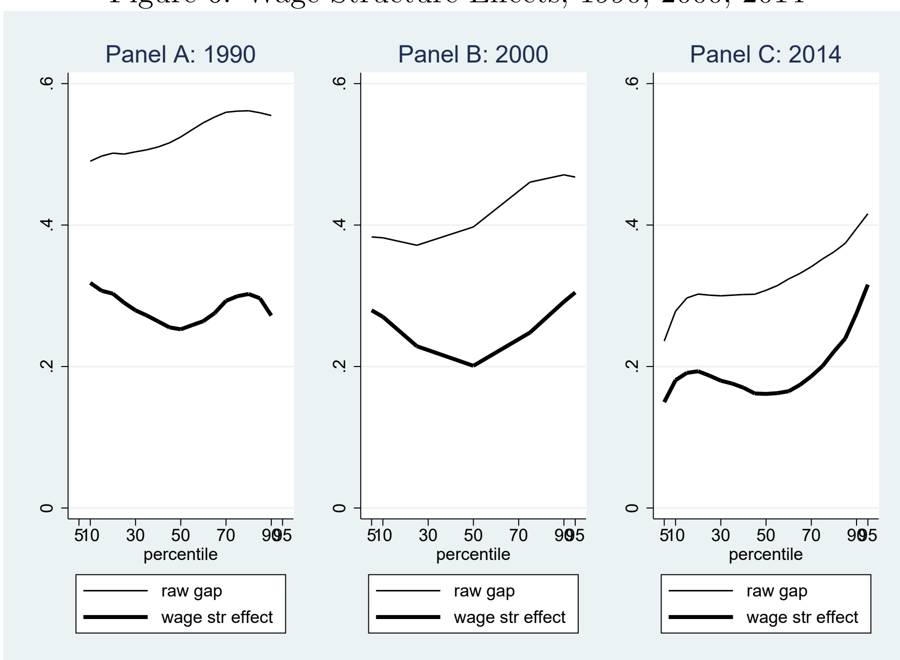
have been more resilient to a decrease, implying that much of the observed decline in the gender wage gap over the past quarter century has been due to reductions in the compositional effect, that is reduction of the gender wage gap in the accumulation of human capital. For example, the gender gap of university enrollment ratio was 18.2% in 1990, but it decreased to 8.9% in 2014.[28]

Next, as for the wage structure effect, or the portion of the gender gap unexplained by gendered differences in human capital, we can see that while

[28] Japanese Ministry of Education, Culture, Sports, Science and Technology *the School Basic Survey*.

the curves have maintained the same basic "U" shape over time, only in 1990 was a decrease in the wage structure effect observed at the very top of the distribution (P85 and P90). In other words, for the last 25 years in Japan, there have been unexplained gender gaps at both the upper and lower ranges of the wage distribution.

Figure 6: Wage Structure Effects, 1990, 2000, 2014



Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.
Notes:

1. The "raw gap" is the estimated raw gender gap, which equals $E[RIF_\tau[lnw_m]] - E[RIF_\tau[lnw_f]]$. The "wage structure effect" equals $\bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$.

Next, Table 6 presents the results of the detailed decomposition for 1990 and 2000, as well as the results for 2014 that are also presented in Table

3, and we just see the results for tenure of the wage structure effects. The absolute value of the return to tenure at the upper range of the distribution was much smaller (more negative) in 1990 than in 2014. It might imply that some of the unexplained benefit to tenure received by women in high-paying jobs has disappeared in recent years.

Table 4: Detailed Decomposition of Wage Structure Effects, 1990 & 2000

Panel A: 1990	P10		P50		P90	
a: Raw log wage gap						
Qt[lnwm]-Qt[lnwf]	0.490	(0.002)	0.525	(0.002)	0.555	(0.004)
b: Estimated wage gap						
E[RIFt[lnwm]]-E[RIFt[lnwf]]	0.490	(0.002)	0.525	(0.002)	0.555	(0.004)
c. Composition effects attributable to						
Tenure	0.105	(0.001)	0.179	(0.001)	0.134	(0.002)
Potential exp	0.039	(0.001)	0.054	(0.001)	0.075	(0.001)
Education	0.029	(0.001)	0.039	(0.001)	0.074	(0.001)
Total	0.172	(0.001)	0.272	(0.001)	0.283	(0.002)
d. Wage structure effects attributable to						
Tenure	0.020	(0.004)	0.002	(0.004)	-0.232	(0.007)
Potential exp	0.511	(0.008)	0.434	(0.006)	0.133	(0.010)
Education	0.040	(0.013)	-0.220	(0.013)	0.098	(0.033)
Constant	-0.253	(0.018)	0.036	(0.014)	0.274	(0.038)
Total	0.318	(0.003)	0.253	(0.002)	0.272	(0.003)
Panel B: 2000	P10		P50		P90	
a: Raw log wage gap						
Qt[lnwm]-Qt[lnwf]	0.381	(0.003)	0.394	(0.002)	0.468	(0.004)
b: Estimated wage gap						
E[RIFt[lnwm]]-E[RIFt[lnwf]]	0.382	(0.003)	0.397	(0.003)	0.471	(0.004)
c. Composition effects attributable to						
Tenure	0.078	(0.001)	0.133	(0.001)	0.102	(0.001)
Potential exp	0.019	(0.001)	0.039	(0.001)	0.043	(0.001)
Education	0.015	(0.000)	0.024	(0.001)	0.034	(0.001)
Total	0.112	(0.001)	0.196	(0.002)	0.179	(0.002)
d. Wage structure effects attributable to						
Tenure	0.006	(0.008)	0.026	(0.005)	-0.176	(0.008)
Potential exp	0.432	(0.013)	0.310	(0.008)	0.040	(0.010)
Education	-0.206	(0.021)	-0.171	(0.017)	-0.235	(0.035)
Constant	0.038	(0.026)	0.036	(0.018)	0.663	(0.040)
Total	0.270	(0.003)	0.201	(0.002)	0.292	(0.003)

Source: Ministry of Health, Labour, and Welfare *Basic Survey on Wage Structure*.

Notes:

1. Bootstrapped standard errors are in parentheses, and the number of reps was 100.

7 Conclusions

This study has found that the gender gap in Japan has generally declined since 1990. We also found that the unexplained wage gap, that is the "wage structure" effects, is larger at both the top and the bottom of the wage distribution, which suggests that Japanese female workers face both a glass ceiling and a sticky floor, and have since 1990.

We also found that these unexplained wage gaps that exist at the extremes of the wage distribution are due at least in part to the ostensibly gender-neutral Japanese human resource management system that continues to segregate men into career-track and women into non-career-track positions. Further, we found that the unexplained gender gap reflects the segregation of women both into jobs at low-paying firms (such as SMEs) and also into low-paying jobs within a firm.

Taking all of the above into consideration, we conclude that despite a general decline in the observed gender gap over the last quarter century, our detailed decomposition analysis has illuminated subtle barriers that continue to exist, particularly at the extremes of the wage distribution, and which comprise a form of labor market discrimination. It is important, therefore, both from an efficiency and an equity standpoint, that these subtle barriers be eliminated. Therefore, the introduction of policies to eliminate these barriers might be necessary in Japan.

References

ALBRECHT, J., A. BJORKLUND, AND S. VROMAN (2003): "Is There a Glass Ceiling in Sweden?," *Journal of Labor Economics*, 21(1), 145–177.

AOKI, M. (1988): *Information, Incentives and Bargaining in the Japanese Economy: A Microtheory of the Japanese Economy.* Cambridge University Press.

ARULAMPALAM, W., A. L. BOOTH, AND M. L. BRYAN (2007): "Is There a Glass Ceiling over Europe? Exploring the Gender Pay Gap across the Wage Distribution," *Industrial & Labor Relations Review*, 60(2), 163–186.

BAYARD, K., J. HELLERSTEIN, D. NEUMARK, AND K. TROSKE (2003): "New Evidence on Sex Segregation and Sex Differences in Wages from Matched Employee-Employer Data.," *Journal of Labor Economics*, 21(4), 887 – 922.

BOOTH, A. L., M. FRANCESCONI, AND J. FRANK (2003): "A Sticky Floors Model of Promotion, Pay, and Gender," *European Economic Review*, 47(2), 295–322.

CARRILLO, P., N. GANDELMAN, AND V. ROBANO (2014): "Sticky Floors and Glass Ceilings in Latin America," *Journal of Economic Inequality*, 12(3), 339–361.

Carrington, W. J., and K. R. Troske (1998): "Sex Segregation in US Manufacturing," *Industrial & Labor Relations Review*, 51(3), 445–464.

Chi, W., and B. Li (2008): "Glass Ceiling or Sticky Floor? Examining the Gender Earnings Differential across the Earnings Distribution in Urban China, 1987–2004," *Journal of Comparative Economics*, 36(2), 243 – 263.

Chiang, H.-Y., and F. Ohtake (2014): "Performance-Pay and the Gender Wage Gap in Japan," *Journal of The Japanese and International Economies*, 34, 71 – 88.

de la Rica, S., J. J. Dolado, and V. Llorens (2008): "Ceilings or Floors? Gender Wage Gaps by Education in Spain," *Journal of Population Economics*, 21(3), 751–776.

Firpo, S., N. M. Fortin, and T. Lemieux (2009): "Unconditional Quantile Regressions," *Econometrica*, pp. 953–973.

Fortin, N. M., and T. Lemieux (1998): "Rank Regressions, Wage Distributions, and the Gender Gap," *Journal of Human Resources*, 33(3), 610–643.

Fortin, N. M., T. Lemieux, and S. Firpo (2011): "Decomposition Methods in Economics," in *Handbook of Labor Economics*, ed. by O. Ashenfelter, and D. Card, vol. 4A, chap. 1, pp. 1–102. Elsevier.

Ichniowski, C., K. Shaw, and G. Prennushi (1997): "The Effects of

Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines," *American Economic Review*, 87(3), 291–313.

Itoh, H. (1994): "Japanese Human Resource Management from the Viewpoint of Incentive Theory," in *The Japanese Firm: The Sources of Competitive Strength*, ed. by H. Itoh, M. Aoki, and R. Dore, pp. 233–265. Oxford University Press Oxford, Oxford.

Javdani, M. (2015): "Glass Ceilings or Glass Doors? The Role of Firms in Male-female Wage Disparities," *Canadian Journal of Economics*, 48(2), 529–560.

Kandel, E., and E. P. Lazear (1992): "Peer Pressure and Partnerships," *Journal of Political Economy*, 100(4), 801–817.

Kato, T., D. Kawaguchi, and H. Owan (2013): "Dynamics of the Gender Gap in the Workplace: An Econometric Case Study of a Large Japanese Firm," RIETI Discussion Paper Series 13-E-038.

Kawaguchi, A. (2005): "The Analysis on the Determinants of the Gender Wage Differencials in 1990s," *Economic Analysis (Keizai Bunseki)*, 175, 52–82, (in Japanese).

——— (2015): "Internal Labor Markets and Gender Inequality: Evidence from Japanese Micro Data, 1990–2009," *Journal of the Japanese and International Economies*, 38, 193–213.

Lazear, E. P. (1979): "Why is There Mandatory Retirement?," *Journal of Political Economy*, 87(6), 1261–1284.

Lazear, E. P., and S. Rosen (1990): "Male-Female Wage Differentials in Job Ladders," *Journal of Labor Economics*, 8(1, Part2), S106–S1238.

Machado, J. A. F., and J. Mata (2005): "Counterfactual Decomposition of Changes in Wage Distributions Using Quantile Regression," *Journal of Applied Econometrics*, 20(4), 445–465.

Mincer, J. A. (1974): "Schooling and Earnings," in *Schooling, Experience, and Earnings*, pp. 41–63. NBER.

Miyoshi, K. (2008): "Male-Female Wage Differentials in Japan," *Japan and the World Economy*, 20(4), 479–496.

Moriguchi, C. (2014): "Japanese-Style Human Resource Management and Its Historical Origins," *Japan Labor Review*, 11(3), 58–77.

Mundlak, Y. (1978): "On the Pooling of Time Series and Cross Section Data," *Econometrica*, 46(1), 69–85.

Osawa, M. (2015): *Why cannot Women Play an Active Role in the Society?* Toyo Keizai Shinpo Sha, Tokyo, (in Japanese).

Pendakur, K., and S. Woodcock (2010): "Glass Ceilings or Glass Doors? Wage Disparity Within and Between Firms," *Journal of Business & Economic Statistics*, 28(1), 181–189.

Schwartz, F. N. (1989): "Management Women and the New Facts of Life," *Harvard Business Review*, January and February, 65–76.

Yamaguchi, K. (2009): "A Path to Resolve the Wage Gap between Men and Women, Work Life Balance," in *Empirical Evidence and Policy Recommendations*, chap. 5, pp. 144–197. Nikkei Publishing Inc., Tokyo, (in Japanese).

Appendix 1

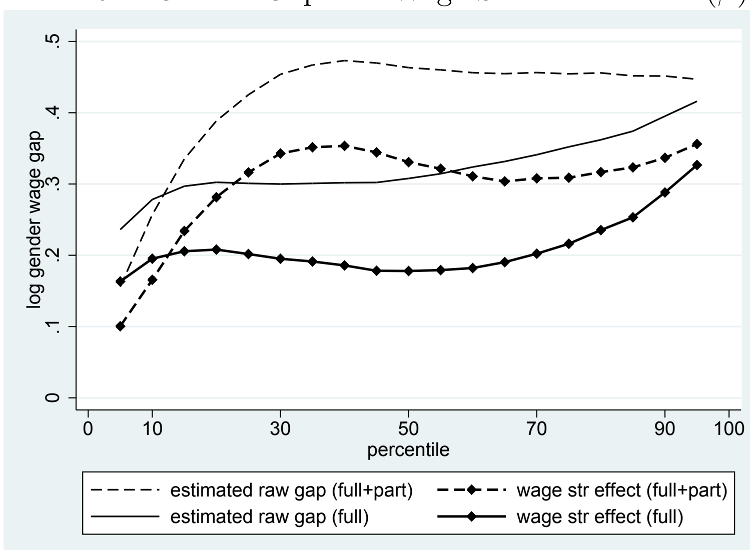
The analysis sample of this study included only full-time workers. However, because of the large proportion of part-time female workers in Japan, we also conducted the same analysis for a sample including both full-time and part-time workers. The results are shown in Figure A1. Note that here we used only tenure and tenure squared as human capital variables to estimate the wage structure effect because the *BSWS* does not survey the academic background of part-time workers.[29]

First, it is obvious that the estimated raw gender gap and wage structure effect for the sample including both full-time and part-time workers was much larger than for the sample including only full-time workers. Second, although the shapes of the two wage structure effect curves in Figure A1 are not exactly the same, the wage structure effect in both become smaller toward the middle of the distribution, reach a peak at the very top of the distribution, and are lowest at the bottom of the range.

The results of these additional estimations suggest that the wage structure effects reported in this study might actually underestimate those for the economy as a whole. The similar patterns of the wage structure effects, however, also suggest that this study provides an accurate description of the subtle barriers in the Japanese labor market.

[29] The wage structure effects for full-time workers reported in Figure 3 were calculated using a broader set of human capital variables including educational background and potential experience and so Figure A1 and Figure 3 are therefore slightly different.

Figure A1: Raw Gender Gap and Wage Structure Effect ($\hat{\beta}$), 2014



Source: Ministry of Health, Labour, and Welfare, *Basic Survey on Wage Structure*.
Notes:

1. "Estimated raw gender gap" $= E[RIF_\tau[lnw_m]] - E[RIF_\tau[lnw_f]]$, and "wage structure effect" $= \bar{X}_m(\hat{\beta}_{m,\tau} - \hat{\beta}_{f,\tau})$.
2. Tenure and tenure squared were included in X.
3. "Full" indicates that only full-time workers were included in the analysis sample, and "full + part" indicates that both full-time and part-time workers were included.

Appendix 2

Table A1: Results of Detailed Decomposition by Firm Size

Panel A: Large-size firm (more than 1000 employees)						
a: Estimated wage gap	P10		P50		P90	
E[RIFt[lnwm]]-E[RIFt[lnwf]]	0.338	(0.003)	0.401	(0.004)	0.473	(0.009)
b. Composition effects attributable to						
Tenure	0.101	(0.003)	0.149	(0.003)	0.132	(0.004)
Potential exp	-0.022	(0.001)	0.024	(0.001)	0.073	(0.003)
Education	0.005	(0.001)	0.010	(0.001)	0.031	(0.003)
Total	0.084	(0.002)	0.183	(0.003)	0.237	(0.005)
c. Wage structure effects attributable to						
Tenure	0.130	(0.010)	-0.020	(0.009)	-0.191	(0.018)
Potential exp	-0.071	(0.018)	0.452	(0.018)	0.220	(0.028)
Education	-0.117	(0.029)	-0.421	(0.031)	0.661	(0.068)
Constant	0.312	(0.036)	0.207	(0.035)	-0.455	(0.078)
Total	0.254	(0.004)	0.218	(0.004)	0.236	(0.008)
Panel B: Small-size firm (less than 100 employees)						
a: Estimated wage gap						
E[RIFt[lnwm]]-E[RIFt[lnwf]]	0.203	(0.005)	0.213	(0.004)	0.306	(0.004)
b. Composition effects attributable to						
Tenure	0.054	(0.002)	0.041	(0.001)	0.005	(0.001)
Potential exp	0.036	(0.002)	0.020	(0.001)	0.007	(0.001)
Education	-0.019	(0.001)	-0.019	(0.001)	-0.009	(0.001)
Total	0.071	(0.003)	0.042	(0.002)	0.003	(0.001)
c. Wage structure effects attributable to						
Tenure	0.156	(0.011)	-0.010	(0.008)	-0.039	(0.008)
Potential exp	0.574	(0.025)	0.062	(0.014)	-0.072	(0.013)
Education	-0.326	(0.041)	-0.372	(0.033)	-0.345	(0.045)
Constant	-0.272	(0.052)	0.491	(0.036)	0.759	(0.051)
Total	0.132	(0.006)	0.170	(0.004)	0.303	(0.004)