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Revisiting the Gender Wage Gap in Korea: Focusing on Working Hours by Occupation[1]

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Abstract

This paper explores the relationship between working hours and the residual gender wage gap in Korea. Because the labor practice of working long hours in Korea favors men, who tend to spend little time on domestic labor, long working hours can influence the residual gender wage gap by discriminating against women. We analyze this discrimination empirically using data from the wage structure parts of the Survey on Labor Conditions by Employment Types from 2009 to 2016, and find the following results. First, the returns from working long hours are not high in most occupations in Korea. Thus, long working hours in Korea could influence the residual gender wage gap through channels other than high overwork premiums in a few high-paying professional occupations. Second, we find that working hours have a positive effect on the residual gender wage gap in male-dominated occupations, but not in female-dominated ones. Thus, the labor practice of working long hours could be a primary factor explaining the large gender wage gap in Korea, where most occupations are male-dominated. Therefore, policymakers should pay more attention to working hours when addressing gender discrimination in Korean labor markets.

Keywords: Residual Gender Wage Gap, Working Hours, Discrimination, Occupation

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Ⅰ. Introduction

A large gender wage gap is one of the most persistent unsolved problems in the Korean labor market. Although its gender wage gap has narrowed significantly since the 1960s, Korea still has the largest gender wage gap among OECD countries[4], and progress has slowed since 2000 (Jung, 2007; Kim, 2015). In fact, according to the Survey Report on Labor Conditions by Employment Type conducted by the Ministry of Employment and Labor, the gender wage gap in Korea has started to increase again[5].

A large gender wage gap in a country harms not only equity, but also efficiency in society. Lower market wages for women compared to men can discourage women from participating in the labor market by lowering their opportunity cost for unemployment or non-economic activities. This can intensify the conventional gender roles in the market and domestic labor by excluding female workers from labor markets and thus hinder the efficient distribution of human capital.

In addition, some of the gender wage gap is attributed to discrimination in the labor market, which lowers women's working morale and their will to invest in education and careers. That can decrease the level of female human capital in the long run and thus negatively affect the entire productivity of the labor market. Also, it can cause severe mismatches between female workers and jobs by forcing many women to choose jobs in fields considered to have less gender discrimination, such as public sector jobs, regardless of their abilities or aptitudes. Therefore, for both gender equality and economic efficiency, it is important to study why the gender wage gap is still large and persistent in Korea.

Because the gender wage gap in Korea has stopped decreasing despite a steady convergence between men and women in labor force participation, educational attainment, market labor experience, and even occupations (Jung, 2007; Oh & Yun, 2014; Kim, 2015; Sa, 2015), it is crucial to thoroughly examine the residual gender wage gap within occupations. Traditionally, many

4 Source: OECD (2016), Gender wage gap (indicator). https://data.oecd.org/earnwage/gender-wage-gap.htm

5 According to the Survey Report on Labor Conditions by Employment Type conducted by the Ministry of Employment and Labor, the average wage level of female paid workers decreased from 68.4% to 64.6% of that of their male counterparts in Korea in the past 5 years. [Figure 1] and [Figure 2] present the trends of the gender wage gap in Korea.

economists have decomposed the wage gap between two groups into two parts, explained and unexplained. The explained part of the gap is caused by differences in human capital, such as education and career levels between the two groups and is usually considered to result from differences in productivity. The unexplained part of the wage gap, the *residual wage gap*, occurs between two observationally identical groups and is often considered to result from discrimination. Because the gender difference in education and career levels has decreased significantly in Korea, it has become increasingly important to explain the residual gender wage gap.

The steady decline in occupational segregation by gender in Korea suggests that the residual gender wage gap *within* occupations deserves more attention. The average wage level of female-dominated occupations tends to be lower than that of male-dominated ones, making occupational segregation by gender a crucial source of the gender wage gap in many countries (Anker et al, 2003; Heo, 2012; Blau et al, 2012). Many domestic studies in Korea have analyzed the gender wage gap by focusing on occupational segregation by gender (Heo, 2003; Keum, 2011; Heo, 2013; Lee et al, 2014). However, as Oh & Yun (2014) and Sa (2015) indicate, occupational segregation by gender has decreased steadily, and many women have moved into higher paying occupations in Korea. Furthermore, Heo (2003) and Goldin (2014) suggest that most of the current gender wage gap comes from within-occupation differences in wages rather than from between-occupation differences. Therefore, when analyzing the gender wage gap, it is now necessary to focus on the residual gender wage gap within occupations, which we here consider, along with working hours by occupation in Korea.

We consider working hours to explain the residual gender wage gap within occupations because the average working hours in Korea are very long, which is often disadvantageous to women, who generally spend much more time on domestic labor than men. Specifically, because loyalty and commitment to the organization by working long hours are important in Korean labor culture (Bae, 2012), men (who can usually spend more time on paid work than women) are likely to be preferred by employers. Thus, the expectation of long working hours can lead to discrimination against women in promotion or job training opportunities, which increases the residual gender wage gap within occupations (Williams, 2000; Blair-Loy, 2003; Shin & Han, 2016).

Several recent studies have investigated the residual gender wage gap within occupations by examining working hours. Cha & Weeden (2013) examine the overwork effect on trends in the gender wage gap in the United States, focusing to professional and managerial occupations, and Goldin (2014) argues that the gender wage gap would be considerably reduced if firms did not disproportionately reward individuals who work long and particular hours, especially in the business, financial, and legal sectors. Cortes & Pan (2016) explore the relationship between the gender gap in working hours, the returns from working long hours, and the gender wage gap among highly educated workers. Wasserman (2017) suggests that reducing the working hours of medical residents allowed more women to enter medical specialties, which could close the physician gender pay gap.

Despite those recent developments in the study of the gender wage gap, few studies have analyzed the relationship between working hours and the gender wage gap in Korea. Although Shin & Han (2016) study the effect of overtime work on gender inequality in organizations in Korea, they focus only on female managerial positions. Also, although many studies have addressed the gender wage gap in Korea from various aspects (Heo, 2003; Keum, 2004; Keum, 2011; Heo, 2013; Lee et al, 2014), they tend to end up decomposing the wage gap into explained and unexplained parts without exploring the reasons for the unexplained part. To the best of our knowledge, this paper contributes to the literature by being the first to use working hours to explain the residual gender wage gap within occupations in Korea.

We also analyze the different effects of long working hours on the residual gender wage gap in male- and female-dominated occupations. Unlike studies that focus on high paying professional occupations to analyze the effect of long working hours on the gender wage gap in the United States, we study the effects of long working hours in all male-dominated occupations in Korea, including blue-collar jobs. The labor practice of working long hours is prevalent not only in high paying professional occupations, but also in most blue-collar occupations in Korea (Bae, 2012; Yi, 2013), and long working hours in those occupations can also contribute to the increasing residual gender wage gap through discrimination against women.

In addition, we compare the effects of working hours on the residual wage gap in male- and female-dominated occupations, expecting that the effect will be more significant in male-dominated occupations. Because working hours are usually longer and male workers can substitute for female

workers for overtime work in male-dominated occupations, we expect to find more gender discrimination caused by the long working hours in those occupations. Therefore, we analyze the relationship between working hours and the residual gender wage gap in male- and female-dominated occupations in Korea and compare the results.

We conduct a panel fixed-effect model regression and a long-difference estimation using data from the wage structure parts of the Survey on Labor Conditions by Employment Types from 2009 to 2016, and find that working hours have a positive effect on the residual gender wage gap in male-dominated occupations but not in female-dominated ones. Also, by estimating wage elasticity with respect to working hours, we provide evidence that the returns from working long hours are not high in most occupations in Korea.

The rest of this paper is organized as follows. Section Ⅱ presents our framework for analyzing the relationship between working hours and the residual gender wage gap by occupation in Korea. Section Ⅲ describes the data used in this paper. Section Ⅳ discusses the main empirical results, and the final section concludes with the implications and constraints of this research.

Ⅱ. Analytical Framework

Many studies have paid attention to long working hours, especially in high paying professional occupations, to address the remaining gender wage gap in the United States (Cha & Weeden, 2013; Gicheva, 2013; Goldin, 2014; Cortes & Pan, 2016; Wasserman, 2017). Those researchers focus on high paying professional occupations, such as those in finance, business, law, and medicine, when analyzing the relationship between working hours and the gender wage gap because those occupations usually entail long working hours and high overwork premiums. They explain that the gender wage gap is more significant and larger in those occupations because of the high return on extended working hours and because men in those occupations spend less time on domestic labor and more time working for pay than women, resulting in a larger gender wage gap.

Despite certain similarities, another layer to the story exists in Korea. Korea is well known for its long working hours, and that practice is prevalent not only in high paying professional

occupations, but also in most blue-collar occupations (Bae, 2012; Yi, 2013). In Korean labor culture, showing loyalty and commitment to an organization/occupation by working long hours is important across all sectors of the labor market (Bae, 2012). Thus, in Korea, overwork premiums might not be significant in occupations with long working hours, and it is not enough to focus only on high paying professional occupations with large overwork premiums when explaining the relationship between working hours and the gender wage gap.

Therefore, in this paper, we analyze the relationship between working hours and the residual gender wage gap in all male- and female-dominated occupations and compare the results. Because long working hours significantly favor male workers who spend little time on domestic labor and working hours are usually longer in male-dominated occupations, we expect that the correlation between working hours and the residual gender wage gap will be more prevalent in male-dominated occupations than in female-dominated ones. Moreover, even if some female-dominated occupations have long working hours, we expect to find little gender discrimination caused by long working hours because it is difficult to replace female workers with male workers for overwork in those occupations,.

For this analysis, we first estimate the elasticity of wages with respect to working hours by occupation and then check whether occupations with longer working hours have high overwork premiums. Then, we examine the relationship between working hours and the residual gender wage gap in male-dominated occupations and compare it with the result from female-dominated occupations. The estimation models for each analysis are as follows.

1. Wage elasticity with respect to working hours by occupation

To estimate wage elasticity with respect to working hours in each occupation, we follow the method suggested by Goldin (2014) and Cortes & Pan (2016). For this analysis, we restrict the sample to 2016 data. The estimation model is as follows.

(1) $\ln(mont\quad ly\_wage_{ijo}) = \alpha + \sum_o \beta_o * I(occ_o = 1) * \ln(working\_\quad ours)_{io} + \pi_o + X_i'\delta + Z_j'\eta + \varepsilon_{ijo}$

The log[6] monthly wage of an individual in occupation o is modeled as a function of the interaction terms of occupation dummies and the log monthly working hours, occupation dummy variables π_o, personal characteristics X_i, establishment characteristics Z_j and an error term. The X_i variables comprise a gender dummy variable, years of education, age, age squared, years of service in the current establishment, and dummy variables for working experience in current occupation and union membership status. The Z_j variables comprise a series of industry and size of establishment dummy variables.[7]

β_o indicates the elasticity of monthly wages with respect to monthly working hours. Specifically, if $\beta_o > 1$, the wage and working hours have a convex relationship such that returns from working long hours in that occupation are high; in other words, monthly wages increase more than proportionally for a given change in monthly hours worked. On the other hand, if $\beta_o < 1$, the relationship between wages and working long hours is concave, with low returns for working long hours (Cortes & Pan, 2016). Therefore, by looking into the estimates of each occupation, we can examine whether high paying professional occupations or other occupations that involve long working hours in Korea have high overwork premiums such as those reported in the United States.

2. The relationship between working hours and residual gender wage gap by occupation

Analyzing the relationship between working hours and the residual gender wage gap by occupation involves two steps. First, we estimate the residual gender wage gap in each occupation using the Oaxaca wage decomposition model. That is, we apply the Oaxaca wage decomposition model to each of 91 occupations for each year and get 728 (91 occupations x 8 years) estimates for the residual gender wage gap. Then, we use those estimates as dependent variables in our panel regression and long-difference estimation.

Because we expect that working hours have different effects on the residual gender wage gap in male- and female-dominated occupations, we conduct a separate panel regression and long-

6 In this paper, "log" refers to the natural logarithm.

7 Details of each variable are described in <Table 1>.

difference estimation for male- and female-dominated occupations. A further explanation of each analysis follows.

A. Oaxaca Wage Decomposition Model

To estimate the residual gender wage gap in each occupation, we set up Mincer (1974)'s wage equation and use Oaxaca (1973)'s wage decomposition model. For robustness, we set up two kinds of wage equations, modeled as follows. The details of each variable used in the equations are given in <Table 1>.

(2) $\ln(\ ourly\_wage_{ij}) = \beta_0 + \beta_1 Overwork_i + \beta_2 X_i^{'} + \delta_1 Z_j^{'} + u_{ij}$

(3) $\ln(mont\ \ ly\_wage_{ij}) = \beta_0 + \beta_1 \ln(working\_\ \ ours_i) + \beta_2 X_i^{'} + \delta_1 Z_j^{'} + u_{ij}$

We model the log hourly wage of an individual as a function of a dummy variable for overwork (working 220 hours or more a month[8]), personal characteristics X_i, establishment characteristics Z_j, and an error term. The X_i variables comprise years of education, age, age squared, years of service in current establishment, and dummy variables for working experience in the current occupation and union membership status. The Z_j variables are a series of industry and size of establishment dummy variables. We include a dummy variable for overwork in the wage equation because working long hours can represent workers' passionate or loyal attitudes toward their jobs, and that can influence their wage levels (Williams, 2000; Blair-Loy, 2003). Also, by controlling for overwork in the wage equation, we obtain a more precise residual gender wage gap that cannot be explained by the gender difference in overwork.

To increase the robustness of our analysis, we construct the alternative form of the wage equation given in (3). Although we follow Cha & Weeden (2014) and Cortes & Pan (2016) in determining the standard of overwork as working 220 hours or more a month, that standard is

8 We follow Cha & Weeden (2014) and Cortes & Pan (2016) in determining the standard for overwork as 220 hours or more a month. They define "overwork" as working 50 hours or more a week, which we recalculate on a monthly basis as 50*4.4=220.

somewhat arbitrary and inapplicable in the Korean labor market. Thus, we model the log monthly wage of an individual as a function of monthly working hours and consider the same explanatory variables used in equation (2). In this way, we can calculate the residual gender wage gap by controlling for workers' attitudes toward their jobs and the gender difference in working hours.

Using those wage equations, we conduct the Oaxaca wage decomposition as follows. First, by applying the wage equation to male and female workers separately, we estimate the coefficients of $\hat{\beta}_m$ and $\hat{\beta}_f$. Then, we can represent the average log wage of men and women as shown in equation (4), where $\bar{X}_m$ and $\bar{X}_f$ indicate the mean values of the explanatory variables for men and women, respectively. By subtracting the average log wage of women from that of men, we can decompose the gender wage gap as shown in equation (5).

(4) $\ln(\bar{W}_m) = \bar{X}_m'\hat{\beta}_m, \ \ln(\bar{W}_f) = \bar{X}_f'\hat{\beta}_f$

(5) $$\begin{aligned}\ln(\bar{W}_m/\bar{W}_f) &= \bar{X}_m'\hat{\beta}_m - \bar{X}_f'\hat{\beta}_f \\ &= (\bar{X}_m' - \bar{X}_f')\beta^* + \bar{X}_m'(\hat{\beta}_m - \beta^*) + \bar{X}_f'(\beta^* - \hat{\beta}_f)\end{aligned}$$

In the equation (5), where β^* indicates a non-discriminatory wage structure, the first term, $(\bar{X}_m' - \bar{X}_f')\beta^*$, represents the gender wage gap caused by the difference in explanatory variables between men and women. The second and last terms represent male wage premiums and female wage penalties, respectively; thus, the sum of those two terms is often considered to be the gender wage gap caused by discrimination or the residual gender wage gap.

Because the size of the residual wage gap changes depending on β^*, many economists have suggest various methods and ideas to estimate β^*. Oaxaca (1973) used $\hat{\beta}_m$ or $\hat{\beta}_f$ as β^* at first, and Blau & Kahn (2016) also used $\hat{\beta}_m$ as β^*, arguing that most existing labor markets are male-dominated, and thus female workers' characteristics are likely to be valued with male coefficients in reality. However, as many economists have pointed out, using $\hat{\beta}_m$ or $\hat{\beta}_f$ as β^* can cause the problem of overestimating or underestimating the residual gender wage gap (Cotton, 1988; Neumark, 1988; Oaxaca & Ransom, 1994; Jann, 2008). Furthermore, because we estimate the residual gender wage

gap for each occupation, some of which are male-dominated and others of which are female-dominated, it is not reasonable to use $\hat{\beta}_m$ or $\hat{\beta}_f$ as β^*. Therefore, we follow the method suggested by Jann (2008), which makes up for the weak points of other methods by obtaining β^* from a pooled regression with a gender dummy variable.

B. Panel Fixed Effect Model

After estimating the residual gender wage gap for each occupation, we analyze the relationship between it and working hours using a panel fixed effect model. Goldin (2014) and Cortes & Pan (2016) study the relationship between returns for working long hours and the gender residual wage gap using cross-sectional data. However, a cross-sectional analysis cannot control for the unobserved inherent characteristics of each occupation. Therefore, we use a panel fixed effect model in this analysis instead. The model is as follows, and the details of the variables are described in <Table 2>.

(6) $\widehat{Residual}_{ot} = \beta_0 + \beta_1 \ln(working\_ours_{ot}) + \beta_2 X_{ot} + \Phi_o + Year_t + \varepsilon_{ot}$

The residual gender wage gap of occupation o at time t is modeled as a function of average log working hours and other characteristics (X_{ot}) of each occupation at time t, occupation and year dummy variables, and an error term. The X_{ot} variables comprise the ratio of female workers within each occupation and the average wage, age, education, and career level of workers employed in each occupation at time t. We control for the ratio of female workers because gender discrimination, which leads to the residual gender wage gap, can be affected by female representation in an occupation through network externalities or changes in the biases or preferences of employers, coworkers, and consumers (Jung, 2007). We include the average wage, age, education, and career levels of workers employed in each occupation because they can represent the characteristics of that occupation. The occupation and year dummy variables represent a two-way fixed effects control.

Because the average wage, age, education, and career level of workers in each occupation do not vary much from year to year, we also conduct a pooled OLS estimation and use both the total working hours and overwork hours as the working_hours variable for robustness. We apply this

model separately to male- and female-dominated occupations to check whether the results are different in the two groups.

C. Long-difference Estimation

For robustness, we also conduct a long-difference estimation using the method designed by Devereux (2005). As shown in (7), this estimation uses the change in the residual gender wage gap of each occupation as a dependent variable and the change in the average log working hours of each occupation as a main explanatory variable.

(7) $\widehat{Residual}_{o,2016} - \widehat{Residual}_{o,2009} = \delta_0 + \delta_1(W\_ours_{o,2016} - W\_ours_{o,2009}) + u_o$

Although it is better to use longer year-differences, the Korean Standard Classification of Occupations was revised in 2009, and connecting the two different coding systems for occupations on a 3-digit level is difficult. Therefore, we use the 7-year difference from 2009 to 2016 in this estimation. Also, as in Devereux (2005), each observation is weighted by the average number of workers employed in each occupation from 2009 to 2016.

We use a multi-year difference estimation to check the robustness of our analysis for two main reasons. First, we can control for the business cycle effect with a multi-year long-difference estimation. By considering the long difference in working hours and the residual gender wage gap in each occupation, we can capture cyclical changes in those variables rather than high frequency changes (Devereux, 2005). Because the business cycle can affect working hours and wage levels through changes in labor supply and demand, it is necessary to control for the business cycle effect, and long difference estimation is one way to do that.

Second, we make a multi-year long-difference estimation to address the reverse causality problem. In any regression analysis, it is important to deal with reverse causality or endogeneity caused by omitted variables. Although long working hours can influence the residual gender wage gap within occupations through discrimination against women, a large residual gender wage gap within occupations could also lead to long working hours. Occupations with higher returns for longer working hours for male workers will attract more male workers who are willing to work long hours.

Therefore, we find that a large residual gender wage gap is more likely to occur in male-dominated occupations, and those male-dominated occupations tend to have longer working hours (Jung, 2007).

We tackle this problem by examining the relationship between changes in working hours and changes in the residual gender wage gap over a long period using the long-difference estimation because a change in the residual gender wage gap within occupations is unlikely to influence the working hours, whereas a change in working hours could affect the residual gender wage gap by changing the working environment or labor practices. Therefore, the multi-year long-difference estimation given in (7) can address the reverse causality problem in our analysis, at least to some extent.

Ⅲ. Data

The data used in this study are the raw data from the wage structure parts of the Survey on Labor Conditions by Employment Types, which surveys regular workers from about 33,000 establishments employing more than 5 regular workers. We restrict the sample to full-time workers aged from 25 to 64 and exclude workers employed in the agriculture, forestry, fishing, mining, and quarrying industries for precision in the analysis. We use data from 2002 to 2016 to observe the trend of the gender wage gap and the change in the mean values of the explanatory variables for men and women. For the panel and long-difference estimation, we use only the data from 2009 to 2016 because the Korean Standard Classification of Occupations was revised in 2009.

Occupations in the data are classified into 91 main groups based on the 2–3 digit levels of the Korean Standard Classification of Occupations. To see whether working hours have different effects on the residual gender wage gap in male- and female-dominated occupations, we classify the occupations into two groups, male- and female-dominated, depending on the gender composition of the workers employed in each occupation.

Regarding the classification of male- and female-dominated occupations, Jung (2007) classifies those in which male or female workers constitute more than 70% of the total workforce as male- or female-dominated occupations, respectively. On the other hand, Kang & Kim (2014)

classify those in which female workers constitute more than 45% of total employment as female-dominated occupations and all others as male-dominated. Although there is not an objective or common standard for classifying occupations as male- or female-dominated, considering those studies and that most occupations in Korea are male-dominated, we classify occupations in which the average ratio of male workers from 2009 to 2016 is above 0.6 as male-dominated and those in which the ratio is less than 0.4 as female-dominated[9].

By this classification, 63 of the 91 occupations are male-dominated, and 14 occupations are female-dominated. The classification of male- and female-dominated occupations and the average ratio of male workers in each occupation are presented in <Table 1> in the Appendix.

<Table 3> gives the mean values for the primary variables of men and women in 2002 and 2016. The gender gap in both log hourly wage and monthly wage decreased between 2002 and 2016. However, [Figure 1] and [Figure 2] show that the gender wage gap stopped decreasing around 2009 and even increased recently. [Figure 3] and [Figure 4] also show that the relative wages of women compared to men have decreased recently.

Meanwhile, the gender gap in both overwork and working hours has increased. Although the working hours of both men and women have decreased, the working hours of women have decreased much more noticeably than those of men. Analyzing the reason for that is beyond the scope of this paper, but the increased gender difference in working hours is an important clue to explain why the gender wage gap has stopped decreasing in Korea. In particular, the fact that the relative wage level of women compared to men is lower in monthly wages than in hourly wages implies that the gender difference in hours of paid work could be a crucial factor explaining the large gender wage gap in Korea. Thus, although this paper focuses on the overall working hours in each occupation to explain the residual gender wage gap within occupations, it also seems necessary to further examine the gender difference in hours of paid work to better explain the increased gender wage gap in Korea.

The mean values of education years, age, and years of service in current occupation have increased for both men and women, and the average ratio of joining a labor union has decreased. Although the gender gap in age and years of service in the current establishment has increased, the

9 We tried the same analyses with a 0.7 standard instead of 0.6, and the results changed little.

gender gap in education years, working experience in current occupation, and union membership status has decreased.

Ⅳ. Empirical Results

1. Wage elasticity with respect to working hours by occupation

The estimates for wage elasticity with respect to the working hours of each occupation are suggested in [Figure 5] with the average wage level of each occupation[10]. Interestingly, only 3 occupations (garment-related workers, automobile drivers, and construction and mining machine operators) have estimates greater than 1, and those are all blue-collar occupations in Korea[11]. Moreover, some high paying professional occupations in Korea have even lower returns on working long hours than other lower paying careers.

In addition, as shown in [Figure 6], many blue-collar occupations have longer monthly working hours than professional occupations. Although occupations with long working hours tend to have higher returns for those long hours, the estimates for those jobs are also lower than 1, which suggests that most occupations in Korea have a concave relationship between wages and working hours and low returns for working long hours.

This result implies that it would be inappropriate to explain the gender wage gap within occupations in Korea by focusing only on the high returns from working long hours in specific high-paying professional occupations. Thus, considering that long working hours can influence the gender wage gap by discriminating against women in even low-paying blue-collar jobs in Korea, we

10 Details about the estimates, working hours, and wage levels for each occupation are given in <Table 2> in the Appendix.

11 We classify occupations into 4 main groups in this paper. We label managers and professionals (occupation codes between 10 and 29) as *professional*, clerks (occupation codes between 300 and 399) as *clerk*, service and sales workers (occupations codes between 40 and 59) as *service & sales*, and craft and related trade workers, equipment, machine operating, assembly workers, and elementary workers (occupation codes between 700 and 999) as *blue-collar*. Details for the occupation classifications are described in <Table 1> in the Appendix, including the codes and names of each occupation.

examine the relationship between working hours and the residual gender wage gap in all male- and female-dominated occupations using the panel and long-difference estimation methods described above.

2. The Relationship Between Working Hours and the Residual Gender Wage Gap

A. Panel Fixed Effect Model Estimation Results

To verify the relationship between working hours and the residual gender wage gap within occupations, we conduct pooled OLS and panel fixed effect model estimations for both male- and female-dominated occupations using 4 different variable settings. First, we use residual estimates from equation (2) for dependent variables and regress them on total working hours and overtime working hours, respectively. Second, we repeat the same procedure using residual estimates from equation (3) as dependent variables. Results are presented in <Table 4>, <Table 5>, <Table 6>, and <Table 7>. In every regression, each observation is weighted by the average number of workers employed in that occupation from 2009 to 2016, and heteroskedasticity is considered.

<Table 4> presents the result of regressing the residual gender wage gap estimates from equation (2) onto the log total working hours using pooled OLS and an occupation-year fixed effect model estimation. Columns (1), (3), (5), and (7) show the results when the log total working hours is used as the only explanatory variable, and columns (2), (4), (6), and (8) show the results when other explanatory variables are controlled.

As shown in <Table 4>, in male-dominated occupations, the coefficients for total working hours are positive and statistically significant in all regressions. On the other hand, in female-dominated occupations, total working hours have a significant positive correlation with the residual gender wage gap within occupations only in the pooled OLS estimation with other explanatory variables added. This result fits our expectation that long working hours would increase the residual gender wage gap by discriminating against women in male-dominated occupations but not in female-dominated ones.

<Table 5> presents the result of regressions using log overtime working hours as an explanatory variable instead of log total working hours, and the results are similar to those in <Table 4>. The results presented in <Table 6> and <Table 7>, which use the residual gender wage gap estimates from equation (3) as dependent variables, also suggest that working hours have a significant positive correlation with the residual gender wage gap only in male-dominated occupations.

The results of all four fixed effect model estimations show that an occupation's average wage level has a significant negative correlation with the residual gender wage gap in both male- and female-dominated occupations. This result is interesting because it suggests that, in Korea, high-paying occupations have a lower residual gender wage gap than low-paying occupations, which is very different from the situation in the United States, where high-paying occupations usually have a higher residual gender wage gap.

B. Long-difference Estimation Results

Although our long-difference estimates could be imprecise as a result of using information from only 2 years of data and running the regression with a small number of observations, they provide a simple illustration of the relationship between changes in working hours and the residual gender wage gap (Devereux, 2005). Also, long-difference estimation has the strength of addressing reverse causality and controlling for the business cycle. As in the panel fixed effect model estimation, we conduct long-difference estimation using residual estimates from both equations (2) and (3). Also, we use changes in both total working hours and overworking hours as explanatory variables. Each observation is weighted by the average number of workers employed in that occupation from 2009 to 2016, and heteroskedasticity is considered in every regression.

<Table 8> presents the result of the long-difference estimation using the residual estimates from equation (2). Columns (1) and (3) present the result when $\triangle\log(total\_working\_\ ours)$ (change in total working hours) is used as an explanatory variable, and columns (2) and (4) present the result when $\triangle\log(Overworking\_\ ours)$ (change in overtime working hours) is used as an explanatory variable. Although the coefficients for the change in working hours are positive in both

male- and female-dominated occupations, they are statistically significant only in male-dominated occupations.

The results presented in <Table 9>, which use residual estimates from equation (3), show that the coefficients of changes in both total working hours and overtime working hours are positive and statistically significant in male-dominated occupations. On the other hand, in female-dominated occupations, only the coefficient of change in total working hours is statistically significant at the 10% level. Therefore, the long-difference estimation results accord with the panel estimation results above.

Ⅴ. Conclusion

In this research, we consider the elasticity of wages with respect to working hours and the relationship between working hours and the residual gender wage gap within occupations in Korea. According to the estimation results, the returns from working long hours are not high in most occupations, even high-paying professional ones, in Korea. This is possibly because the labor practice of working long hours is common in Korea, but it implies that long working hours can influence the residual gender wage gap through discrimination against women in even low-paying blue-collar occupations in Korea. However, the data from the wage structure parts of the Survey on Labor Conditions by Employment Types used in this analysis classify the occupations on 2–3 digit levels and have a relatively small number of observations for professional and managerial occupations. Therefore, we recommend that future analysis consider the relationship between wages and working hours in those occupations using more specific establishment or workplace data.

The main result of this paper is that working hours have a statistically significant positive effect on the residual gender wage gap in male-dominated occupations but not in female-dominated ones. This suggests that the labor practice of working long hours and recognizing overwork as a signal of loyalty to organizations could be a primary factor explaining the large gender wage gap in Korea, where most occupations are male-dominated. Therefore, efforts to reduce the overall working hours in the Korean labor market might also help decrease the gender wage gap. Also, policymakers

should pay more attention to working hours and other labor or cultural practices in Korea to address gender discrimination in the Korean labor market

Although the results show that the coefficients for working hours are not statistically significant in female-dominated occupations, we recommend care in interpretation because the number of female-dominated occupations is small, and the data used in this analysis are restricted to full-time regular workers. Many women in Korea are irregular workers or have part-time jobs, so future research should analyze the gender wage gap in Korea using more inclusive data. Including the data for irregular and part-time workers in analyzing the relationship between working hours and the gender wage gap might produce a more significant result because the gender difference in working hours would get larger. Therefore, to examine the relationship between working hours and the gender wage gap in Korea more thoroughly, future researchers should analyze this issue using richer data and various methods.

<Table 1> Description of Variables Used in the Wage Equation

Variables	Variable Names	Description
Dependent Variables	ln(hourly_wage)	hourly_wage = (monthly regular payment + monthly overwork payment + annual bonus/12) / (monthly regular working hours + monthly overtime working hours)
	ln(monthly_wage)	monthly_wage = monthly regular payment + monthly overwork payment + annual bonus/12
Explanatory Variables	Overwork	Dummy variable: working 220 hours or more a month = 1, 0 otherwise
	ln(working_hours)	working_hours = monthly regular working hours + monthly overtime working hours
	Edu	Education years: less than middle school graduation = 9, high school graduation = 12, college graduation = 14, university graduation = 16, graduate school graduation = 18
	Age	
	Age2	age squared
	Tenure	years of service at current establishment
	Carr1–Carr7	Dummy variables for working experience in the current occupation: less than 1 year = Carr1, 1–2 years = Carr2, 2–3 years = Carr3, 3–4 years = Carr4, 4–5 years = Carr5, 5–10 years = Carr6, more than 10 years = Carr7 (criteria variable: Carr1)
	Union	(member of labor union) = 1, 0 otherwise
	Ind1–Ind7	Dummy variables for industry: manufacturing = Ind1, electricity, gas, water supply=Ind2, construction = Ind3, wholesale and retail trade/accommodation and food service = Ind4, transportation and storage/information and communication = Ind5, financial and insurance/administrative and support service activities = Ind6, others = Ind7 (criteria variable: Ind1)
	Esize1–Esize6	Dummy variables for establishment size: 5–9 employees = Esize1, 10–29 employees = Esize2, 30–99 employees = Esize3, 100–299 employees = Esize4, 300–499 employees = Esize5, more than 500 employees = Esize6 (criteria variable: Esize1)

Notes: 1) We classify industries into 7 groups following Jung (2007). Specifically, on the basis of the International Standard Industrial Classification, we categorize industry code C as Ind1, D and E as Ind2, F as Ind3, G and I as Ind4, H and J as Ind5, K and N as Ind6, and all others as Ind7.

<Table 2> Description of Variables Used in Panel Regression

Variables	Variable Names	Description
Dependent Variables	Residual	residual gender wage gap estimated from Oaxaca wage decomposition using wage equations (2) and (3)
Explanatory Variables	ln(TWH)	TWH=monthly total working hours
	ln(OWH)	OWH=monthly overtime working hours
	F_RATIO	female ratio within occupation
	A_WAGE	average log monthly wage of workers employed in the occupation
	A_EDU	average education years of workers employed in the occupation
	A_AGE	average age of workers employed in the occupation
	A_CARR	average career level of workers employed in the occupation

<Table 3> Mean Values of Primary Variables of Men and Women

Variables	2002			2016		
	Men	Women	Difference	Men	Women	Difference
ln(hourly_wage)	2.4403	1.9446	0.4956	3.0199	2.6376	0.3823
ln(monthly_wage)	7.7166	7.2083	0.5082	8.2308	7.8219	0.4088
Overwork	0.2702	0.2488	0.0213	0.1388	0.0836	0.0551
ln(TWH)	5.2763	5.2636	0.0126	5.2108	5.1842	0.0265
ln(OWH)	3.5116	3.3445	0.1670	3.2752	2.9234	0.3517
Edu	13.7480	12.5726	1.1754	14.4160	14.0415	0.3744
Age	38.1833	37.3251	0.8581	42.1339	40.1916	1.9422
Age2	1533.419	1496.204	37.215	1873.795	1728.666	145.129
Tenure	7.8093	5.1233	2.6860	8.3923	5.3709	3.0213
Carr1	0.0648	0.1070	-0.0421	0.0916	0.1321	-0.0405
Carr2	0.0752	0.1152	-0.0400	0.0817	0.1192	-0.0374
Carr3	0.0719	0.1066	-0.0347	0.0671	0.0942	-0.0270
Carr4	0.0503	0.0785	-0.0282	0.0637	0.0870	-0.0232
Carr5	0.0398	0.0569	-0.0171	0.0643	0.0843	-0.0200
Carr6	0.2542	0.2824	-0.0282	0.1876	0.2112	-0.0235
Carr7	0.4435	0.2529	0.1905	0.4437	0.2718	0.1718
Union	0.5893	0.4310	0.1582	0.2595	0.1629	0.0965
N	264,424	66,879		420,112	217,994	

<Table 4> Relationship Between Total Working Hours and the Residual Gender Wage Gap in Male- and Female-Dominated Occupations (residual estimates from equation (2))

Dependent Variable: Residual Gender Wage Gap Within Occupations

	Male-dominated occupations				Female-dominated occupations			
	Pooled OLS		Fixed Effect		Pooled OLS		Fixed Effect	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
log(TWH)	0.595*** (0.0551)	0.387*** (0.0757)	0.516*** (0.1820)	0.288** (0.1126)	0.138 (0.1005)	0.330*** (0.0787)	0.163 (0.2074)	0.039 (0.1284)
F_RATIO		-0.0002 (0.0434)		0.325 (0.2530)		-0.290*** (0.0914)		-0.030 (0.1311)
A_WAGE		-0.026 (0.0311)		-0.207*** (0.0748)		-0.053 (0.0729)		-0.45*** (0.0936)
A_EDU		-0.02*** (0.0073)		0.015 (0.0388)		0.019 (0.0270)		0.131** (0.0512)
A_AGE		-0.009*** (0.0014)		0.0002 ((0.0074)		0.003 (0.0033)		0.006 (0.0051)
A_CARR		0.012*** (0.0024)		0.010 (0.0070)		0.043*** (0.0083)		0.017 (0.0136)
CONS	-2.94*** (0.2876)	-1.098** (0.4858)	-2.512** (0.9562)	-0.013 (0.7532)	-0.494 (0.5226)	-1.465*** (0.5472)	-0.617 (1.0900)	1.410 (0.9270)
YEAR FE			○	○			○	○
Adj. R^2	0.33	0.45	0.24	0.13	0.02	0.37	0.04	0.04
N	469	469	469	469	105	105	105	105

Notes: 1) YEAR FE represents year fixed effects, and N is the number of observations.
For details of each variable, see <Table 2>.
2) Robust standard errors are in parentheses.
3) * p< 0.1, ** p< 0.05, *** p< 0.01

<Table 5> Relationship Between Overtime Working Hours and the Residual Gender Wage Gap in Male- and Female-Dominated Occupations (residual estimates from equation (2))

Dependent Variable: Residual Gender Wage Gap Within Occupations

	Male-dominated occupations				Female-dominated occupations			
	Pooled OLS		Fixed Effect		Pooled OLS		Fixed Effect	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
log(OWH)	0.128***	0.098***	0.123**	0.093**	0.016	0.072***	-0.052	-0.034
	(0.0127)	(0.0206)	(0.0538)	(0.0461)	(0.0251)	(0.0269)	(0.0532)	(0.0288)
F_RATIO		-0.006		0.249		-0.261***		-0.076
		(0.0443)		(0.2546)		(0.0934)		(0.1402)
A_WAGE		-0.058*		-0.275***		-0.102		-0.45***
		(0.0328)		(0.0658)		(0.0825)		(0.0800)
A_EDU		-0.013		0.016		0.020		0.124**
		(0.0088)		(0.0393)		(0.294)		(0.0506)
A_AGE		-0.010***		-0.001		0.001		0.006
		(0.0015)		(0.0073)		(0.0035)		(0.0059)
A_CARR		0.014***		0.016**		0.043***		0.016
		(0.0023)		(0.0074)		(0.0086)		(0.0139)
CONS	-0.26***	0.808***	-0.195	1.743***	0.177**	0.448	0.418**	1.810***
	(0.0395)	(0.2047)	(0.1721)	(0.5377)	(0.0727)	(0.3096)	(0.1541)	(0.4652)
YEAR FE			○	○			○	○
Adj. R^2	0.27	0.43	0.27	0.20	0.003	0.34	0.02	0.05
N	469	469	469	469	105	105	105	105

Notes: 1) YEAR FE represents year fixed effects, and N is the number of observations.
For details of each variable, see <Table 2>.
2) Robust standard errors are in parentheses.
3) * p< 0.1, ** p< 0.05, *** p< 0.01

<Table 6> Relationship Between Total Working Hours and the Residual Gender Wage Gap in Male- and Female-Dominated Occupations (residual estimates from equation (3))

Dependent Variable: Residual Gender Wage Gap Within Occupations

	Male-dominated occupations				Female-dominated occupations			
	Pooled OLS		Fixed Effect		Pooled OLS		Fixed Effect	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
log(TWH)	0.583*** (0.0575)	0.376*** (0.0771)	0.433** (0.1873)	0.254** (0.1293)	0.121 (0.1001)	0.311*** (0.0779)	0.164 (0.1963)	-0.019 (0.1346)
F_RATIO		-0.007 (0.0447)		0.295 (0.2528)		-0.309*** (0.0929)		-0.037 (0.1329)
A_WAGE		-0.037 (0.0316)		-0.213*** (0.0818)		-0.067 (0.0731)		-0.43*** (0.0920)
A_EDU		-0.019** (0.0073)		0.014 (0.0394)		0.027 (0.0267)		0.117** (0.0465)
A_AGE		-0.010*** (0.0013)		-0.001 (0.0079)		0.005 (0.0033)		0.006 (0.0051)
A_CARR		0.017*** (0.0024)		0.010 (0.0071)		0.042*** (0.0083)		0.019 (0.0136)
CONS	-2.87*** (0.3004)	-0.938* (0.4919)	-0.067** (0.9828)	0.306 (0.8071)	-0.397 (0.5202)	-1.394** (0.5418)	-0.616 (1.0318)	1.719* (0.9189)
YEAR FE			○	○			○	○
Adj. R^2	0.31	0.46	0.24	0.14	0.01	0.35	0.04	0.04
N	465	465	465	465	105	105	105	105

Notes: 1) YEAR FE represents year fixed effects, and N is the number of observations.
For details of each variable, see <Table 2>.
2) Robust standard errors are in parentheses.
3) * p< 0.1, ** p< 0.05, *** p< 0.01

<Table 7> Relationship Between Overtime Working Hours and the Residual Gender Wage Gap in Male- and Female-Dominated Occupations (residual estimates from equation (3))

Dependent Variable: Residual Gender Wage Gap Within Occupations

	Male-dominated occupations				Female-dominated occupations			
	Pooled OLS		Fixed Effect		Pooled OLS		Fixed Effect	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
log(OWH)	0.125*** (0.129)	0.100*** (0.0210)	0.127** (0.0542)	0.095** (0.0476)	0.020 (0.0251)	0.073*** (0.0272)	-0.053 (0.0508)	-0.025 (0.0285)
F_RATIO		-0.012 (0.0446)		0.219 (0.2543)		-0.282*** (0.0943)		-0.069 (0.1378)
A_WAGE		-0.071** (0.0330)		-0.277*** (0.0733)		-0.119 ((0.081)		-0.42*** (0.0734)
A_EDU		-0.011 (0.0090)		0.017 (0.0393)		0.030 (0.0287)		0.113** (0.0456)
A_AGE		-0.011*** (0.0015)		-0.003 (0.0077)		0.003 (0.0034)		0.006 (0.0057)
A_CARR		0.016*** (0.0024)		0.016** (0.0074)		0.043*** (0.0086)		0.018 (0.0136)
CONS	-0.24*** (0.0401)	0.893*** (0.2037)	-0.198 (0.1732)	1.808*** (0.5323)	0.171** (0.0726)	0.409 (0.3073)	0.396 (0.1475)	1.672*** (0.4697)
YEAR FE			○	○			○	○
Adj. R^2	0.26	0.44	0.28	0.21	0.005	0.33	0.03	0.05
N	465	465	465	465	105	105	105	105

Notes: 1) YEAR FE represents year fixed effects, and N is the number of observations.
For details of each variable, see <Table 2>
2) Robust standard errors are in parentheses.
3) * p< 0.1, ** p< 0.05, *** p< 0.01

<Table 8> Results of Long-difference Estimation (residual estimates from equation (2))

Dependent Variable: Change in the Residual Gender Wage Gap

	Male-dominated occupations		Female-dominated occupations	
Explanatory Variable	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
change in log total working hours	0.778* (0.4019)		0.941 (0.5747)	
change in log overtime working hours		0.146* (0.0752)		0.045 (0.1197)
constant	-0.031 (0.0290)	-0.065*** (0.0187)	0.023 ((0.0426)	-0.020 ((0.0263)
Adjusted R^2	0.06	0.08	0.08	0.01
N	58	58	13	13

Notes: 1) Robust standard errors are in parentheses.
2) * p< 0.1, ** p< 0.05, *** p< 0.01

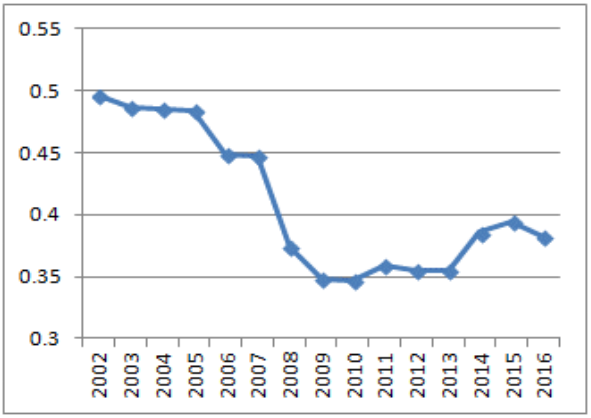
<Table 9> Results of Long-difference Estimation (residual estimates from equation (3))

Dependent Variable: Change in the Residual Gender Wage Gap

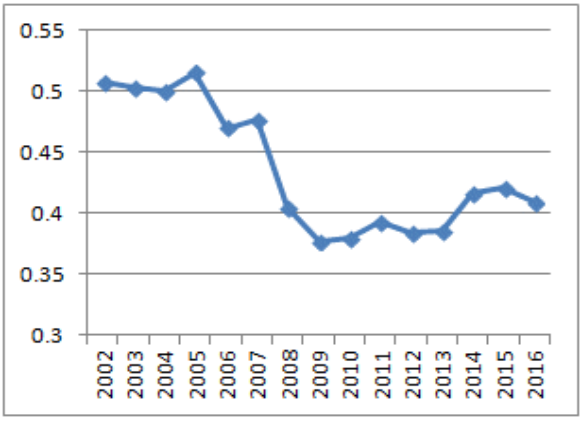
	Male-dominated occupations		Female-dominated occupations	
Explanatory Variable	(1)	(2)	(3)	(4)
	Coef.	Coef.	Coef.	Coef.
change in total working hours	0.773* (0.4170)		1.016* (0.5640)	
change in overtime working hours		0.155** (0.0769)		0.057 (0.1137)
constant	-0.034 (0.0299)	-0.067*** (0.0193)	0.029 (0.0425)	-0.018 (0.0264)
Adjusted R^2	0.06	0.08	0.09	0.02
N	58	58	13	13

Notes: 1) Robust standard errors are in parentheses.
2) * p< 0.1, ** p< 0.05, *** p< 0.01

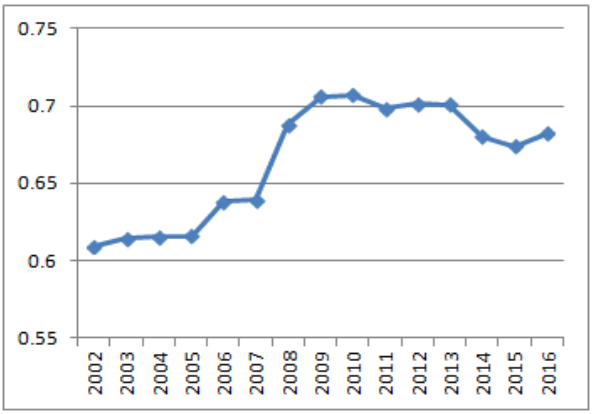
[Figure 1] Gender gap in ln(hourly_wage)



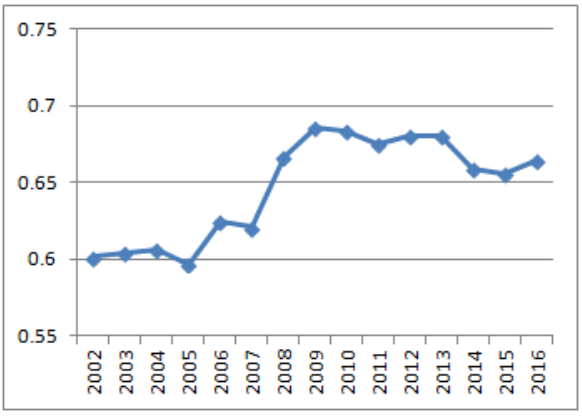
[Figure 2] Gender gap in ln(monthly_wage)



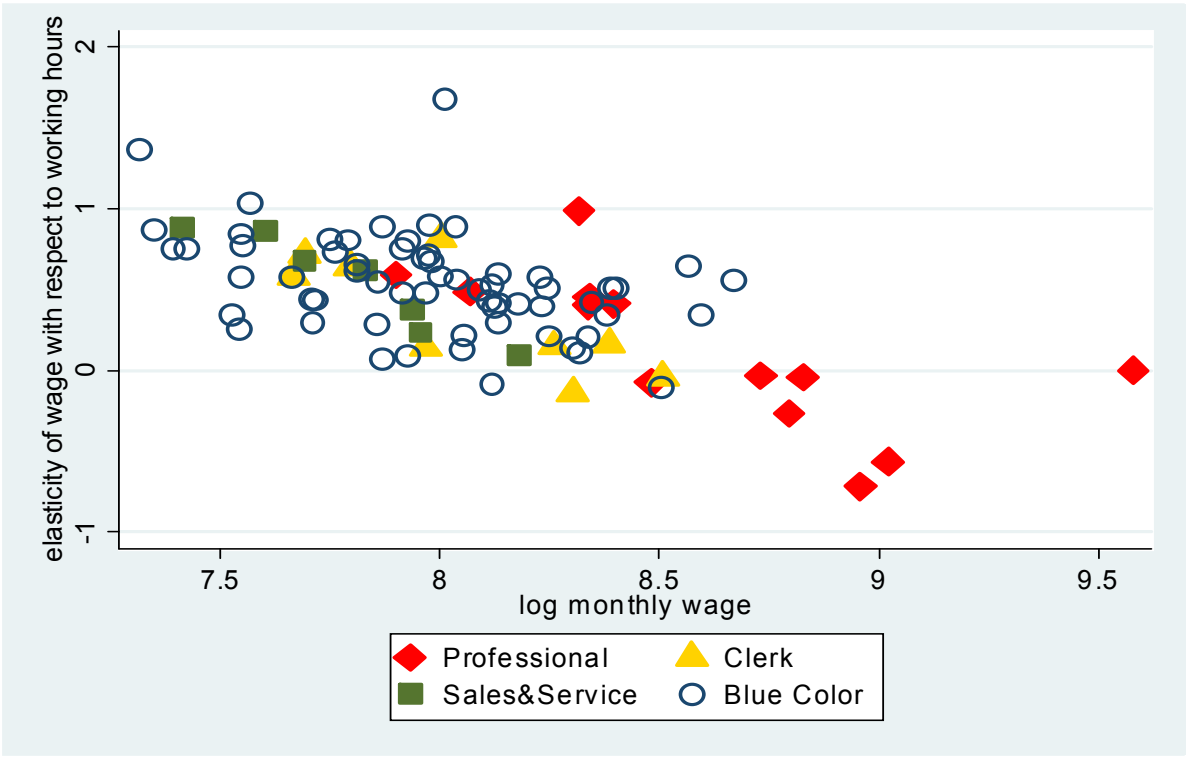
[Figure 3] Relative wage of women compared to men (hourly_wage)



[Figure 4] Relative wage of women compared to men (monthly_wage)



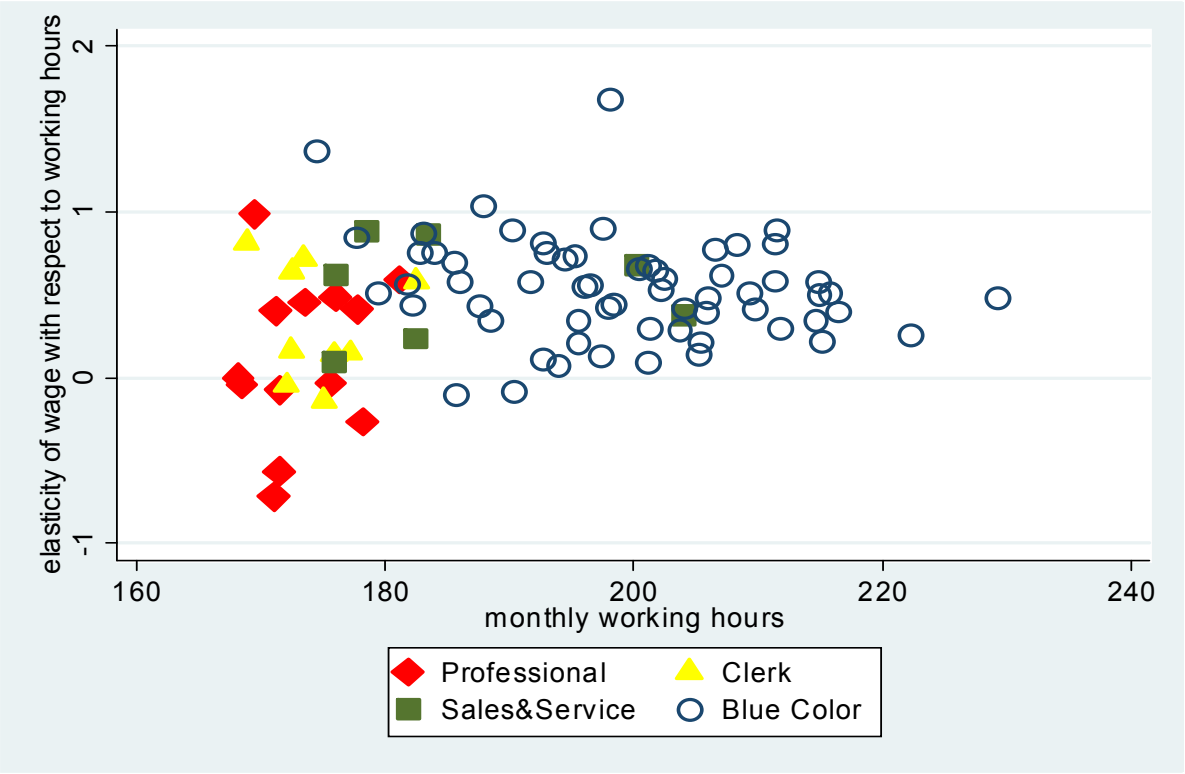
[Figure 5] Relationship Between Wage Elasticity with Respect to Working Hours and Log Monthly Wage



Notes: 1) 91 occupations are graphed in this figure.

2) Estimates of wage elasticity with respect to working hours are calculated from equation (1) with 2016 data, and monthly wage refers to the average monthly wage level for each occupation in 2016.

[Figure 6] Relationship Between Wage Elasticity with Respect to Working Hours and Monthly Working Hours



Notes: 1) 91 occupations are graphed in this figure.
2) Estimates of wage elasticity with respect to working hours are calculated from equation (1) with 2016 data, and monthly working hours refer to the average monthly working hours for each occupation in 2016.

Appendix

<Table 1> Classification of Male- and Female-dominated Occupations

	Code	Occupation Name	M_RATIO
Male-Dominated Occupations	110	Public and Enterprise Senior Officials	0.9623
	120	Administrative and Business Support Management Occupations	0.9055
	130	Professional Services Management Occupations	0.8415
	140	Construction, Electricity, and Production Related Managers	0.9524
	150	Sales and Customer Service Managers	0.8931
	210	Science Professionals and Related Occupations	0.6557
	220	Information and Communication Professionals and Technical Occupations	0.8496
	230	Engineering Professionals and Technical Occupations	0.9007
	260	Legal and Administration Professional Occupations	0.7915
	270	Business and Finance Professionals and Related Occupations	0.8056
	311	Administration Clerks	0.6616
	312	Administration Related Clerks	0.7559
	330	Legal and Inspection Occupations	0.6717
	410	Police, Firefighting, and Security Related Service Occupations	0.9184
	510	Sales Occupations	0.8701
	730	Wood and Furniture, Musical Instrument, and Signboard Related Trade Occupations	0.8585
	741	Die and Mold Makers, Metal Casting Workers and Forge Hammersmiths	0.9456
	742	Pipe and Sheet Metal Makers	0.9540
	743	Welders	0.9513
	751	Automobile Mechanics	0.9867
	752	Transport Equipment Mechanics	0.9830
	753	Machinery Equipment Fitters and Mechanics	0.9746

	761	Electric and Electronic Machine Fitters and Repairers	0.9537
	762	Electricians	0.9763
	771	Construction Structure Related Workers	0.9764
	772	Construction Related Technical Workers	0.9481
	773	Construction Finishing Related Technical Workers	0.9212
	774	Mining and Civil Engineering Related Technical Workers	0.9781
	780	Video and Telecommunications Equipment Related Fitters and Repairers	0.9708
	791	Handcraft Workers and Precious Metalsmiths	0.6446
	792	Plumbers	0.9701
	799	Other Technical Workers	0.6961
	812	Beverage Processing Machine Operators	0.7725
	819	Other Food Processing Related Machine Operators	0.6817
	821	Textile Production and Processing Machine Operators	0.6620
	831	Petroleum and Chemical Material Processing Machine Operators	0.9596
	832	Chemical, Rubber, and Plastic Production Machine Operators	0.7653
	841	Metal Casting and Metal Processing Related Operators	0.9307
	842	Painting and Coating Machine Operators	0.8775
	843	Nonmetal Product Production Machine Operators	0.8537
	851	Machine Tool Operators	0.9071
	852	Cooling and Heating Related Equipment Operators	0.9861
	853	Factory Automation and Industrial Robot Operators	0.9113
	854	Transport Vehicle and Machine Related Assemblers	0.8070
	855	Metal Machinery Parts Assemblers	0.7421
	861	Power Generation and Distribution Equipment Operators	0.9782
	862	Electrical and Electronic Equipment Operators	0.9717
	863	Electrical, Electronic Part, and Product Production Equipment Operators	0.6448

	871	Locomotive Drivers	0.9908
	872	Freight Train Director and Related Workers	0.9239
	873	Automobile Drivers	0.9848
	874	Handling Equipment Operators	0.9859
	875	Construction and Mining Machines Operators	0.9941
	876	Ship Deck Workers and Related Workers	0.9891
	881	Water Treatment Plant Operators	0.9706
	882	Recycling Machine and Incinerator Operators	0.9417
	891	Wood and Paper Related Operators	0.8773
	892	Print and Photo Development Related Machine Operators	0.8736
	910	Construction and Mining Elementary Workers	0.9054
	921	Loading and Lifting Elementary Workers	0.9112
	922	Deliverers	0.9308
	942	Guards and Ticket Examiners	0.9630
	992	Meter Reading, Money Collecting, and Parking Controlling Related Workers	0.6079
Female-Dominated Occupations	240	Health, Social Welfare, and Religion Related Occupations	0.2125
	313	Accounting Related Clerks	0.2463
	314	Secretaries and Assistant Clerks	0.2644
	392	Travel, Information, and Reception Clerks	0.2666
	399	Customer Service Workers	0.2341
	420	Hairdressing, Wedding, and Medical Assistance Service Workers	0.1978
	440	Cooking and Food Service Occupations	0.3159
	520	Store Sales Occupations	0.3657
	530	Door to Door, Street, and Telecommunications Sales Related Occupations	0.3139
	721	Textile and Leather Related Workers	0.2923
	722	Garment Related Workers	0.2817
	941	Cleaner and Sanitation Workers	0.3110
	951	Domestic Chores and Infant Rearing Helpers	0.0235

	952	Food Related Elementary Workers	0.1637
Others	250	Education Professionals and Related Occupations	0.5517
	280	Culture, Arts, and Sports Professionals and Related Occupations	0.5507
	320	Finance and Insurance Clerks	0.5586
	391	Statistics Related Clerks	0.5442
	430	Transport and Leisure Services Occupations	0.4981
	710	Food Processing Related Trade Workers	0.4037
	811	Food Processing Related Operating Occupations	0.5777
	822	Textile and Shoe Related Machine Operators and Assemblers	0.5215
	823	Laundry Related Machine Operators	0.4317
	864	Electrical, Electronic Parts, and Products Assembler	0.4618
	899	Other Production Related Machine Operators	0.5890
	930	Production Related Elementary Workers	0.4821
	953	Sales Related Elementary Workers	0.5331
	999	Other Service Related Elementary Workers	0.4930

Notes: 1) M_RATIO is the average ratio of male workers in each occupation from 2009 to 2016.
2) We classify occupations whose M_RATIO is above 0.6 as male-dominated occupations and those whose M_RATIO is below 0.4 as female-dominated occupations.

<Table 2> Estimates for Wage Elasticity with Respect to Working Hours of Occupations and Average Working Hours and Wage Level of Workers Employed in Each Occupation

Code	Occupation Name	ESTI.	HOUR	WAGE
11	Public and Enterprise Senior Officials	0.0000	168.24	9.5796
12	Administrative and Business Support Management Occupations	-0.5612	171.48	9.0218
13	Professional Services Management Occupations	-0.7187	171.12	8.9583
14	Construction, Electricity, and Production Related Managers	-0.2669	178.22	8.7975
15	Sales and Customer Service Managers	-0.0290	175.63	8.7315
21	Science Professionals and Related Occupations	0.9911	169.51	8.3178
22	Information and Communication Professionals and Technical Occupations	0.4558	173.57	8.3409
23	Engineering Professionals and Technical Occupations	0.4136	177.78	8.3981
24	Health, Social Welfare, and Religion Related Occupations	0.5922	181.14	7.9005
25	Education Professionals and Related Occupations	0.4045	171.22	8.3380
26	Legal and Administration Professional Occupations	-0.0395	168.51	8.8278
27	Business and Finance Professionals and Related Occupations	-0.0728	171.56	8.4806
28	Culture, Arts, and Sports Professionals and Related Occupations	0.4864	176.01	8.0686
311	Administration Clerks	-0.1387	175.13	8.3047
312	Administration Related Clerks	0.1495	177.17	8.2600
313	Accounting Related Clerks	0.1422	175.91	7.9669
314	Secretaries and Assistant Clerks	0.7169	173.45	7.6927
320	Finance and Insurance Clerks	0.1672	172.45	8.3875
330	Legal and Inspection Occupations	-0.0412	172.10	8.5080
391	Statistics Related Clerks	0.8180	168.94	8.0033
392	Travel, Information, and Reception Clerks	0.5811	182.53	7.6667
399	Customer Service Workers	0.6393	172.52	7.7971
41	Police, Firefighting, and Security Related Service Occupations	0.3770	204.03	7.9389
42	Hairdressing, Wedding, and Medical Assistance Service Workers	0.8871	178.59	7.4147

43	Transport and Leisure Services Occupations	0.2368	182.52	7.9574
44	Cooking and Food Service Occupations	0.6838	200.25	7.6934
51	Sales Occupations	0.0930	175.94	8.1836
52	Store Sales Occupations	0.8633	183.54	7.6052
53	Door to Door, Street, and Telecommunications Sales Related Occupations	0.6228	176.03	7.8313
710	Food Processing Related Trade Workers	0.6236	207.03	7.8094
721	Textile and Leather Related Workers	0.5832	191.66	7.6602
722	Garment Related Workers	1.3727	174.49	7.3135
730	Wood and Furniture, Musical Instrument, and Signboard Related Trade Occupations	0.3014	201.34	7.7094
741	Die and Mold Makers, Metal Casting Workers, and Forge Hammersmiths	0.5160	209.34	8.2443
742	Pipe and Sheet Metal Makers	0.5301	202.14	8.1186
743	Welders	0.6041	202.46	8.1304
751	Automobile Mechanics	-0.0765	190.33	8.1174
752	Transport Equipment Mechanics	0.5124	179.47	8.3861
753	Machinery Equipment Fitters and Mechanics	0.2104	195.54	8.3354
761	Electric and Electronic Machine Fitters and Repairers	0.7046	185.56	7.9628
762	Electrician	0.4354	187.58	8.1104
771	Construction Structure Related Workers	0.0776	193.90	7.8690
772	Construction Related Technical Workers	0.7554	183.94	7.9146
773	Construction Finishing Related Technical Workers	0.5553	195.99	7.8567
774	Mining and Civil Engineering Related Technical Workers	0.2262	215.08	8.0534
780	Video and Telecommunications Equipment Related Fitters and Repairers	0.5674	181.80	8.0368
791	Handcraft Workers and Precious Metalsmiths	0.4412	182.27	7.7139
792	Plumbers	0.8929	190.26	8.0348
799	Other Technical Workers	0.7382	195.26	7.7618
811	Food Processing Related Operating Occupations	0.8975	211.51	7.8667
812	Beverage Processing Machine Operators	0.3504	214.62	8.3796
819	Other Food Processing Related Machine Operators	0.4251	197.88	8.3442

821	Textile Production and Processing Machine Operators	0.4849	229.20	7.9122
822	Textile and Shoe Related Machine Operators and Assemblers	0.2939	203.67	7.8538
823	Laundry Related Machine Operators	0.3484	195.51	7.5274
831	Petroleum and Chemical Material Processing Machine Operators	0.6497	201.70	8.5642
832	Chemical, Rubber, and Plastic Production Machine Operators	0.4026	216.48	8.2321
841	Metal Casting and Metal Processing Related Operators	0.5854	214.82	8.2271
842	Painting and Coating Machine Operators	0.4130	209.67	8.1776
843	Nonmetal Products Production Machine Operators	0.4229	204.12	8.1317
851	Machine Tool Operators	0.5071	214.90	8.0892
852	Cooling and Heating Related Equipment Operators	0.0968	201.12	7.9269
853	Factory Automation and Industrial Robot Operators	0.5169	215.76	8.4001
854	Transport Vehicle and Machine Related Assemblers	0.2163	205.40	8.2484
855	Metal Machinery Parts Assemblers	0.7160	194.43	7.9734
861	Power Generation and Distribution Equipment Operators	0.3464	188.50	8.5954
862	Electrical and Electronic Equipment Operators	0.1348	197.29	8.0509
863	Electrical, Electronic Parts, and Products Production Equipment Operators	0.1486	205.16	8.2995
864	Electrical, Electronic Parts and Products Assembler	0.6779	201.18	7.9776
871	Locomotive Drivers	0.5618	196.43	8.6665
872	Freight Train Director and Related Workers	-0.0990	185.63	8.5028
873	Automobile Drivers	1.0422	187.81	7.5653
874	Handling Equipment Operators	0.3943	205.74	8.1241
875	Construction and Mining Machines Operators	1.6833	198.12	8.0099
876	Ship Deck Workers and Related Workers	0.9058	197.50	7.9747
881	Water Treatment Plant Operators	0.1174	192.65	8.3182
882	Recycling Machine and Incinerator Operators	0.5895	211.36	7.9995
891	Wood and Paper Related Operators	0.3034	211.76	8.1308
892	Print and Photo Development Related Machine Operators	0.4856	206.01	7.9675
899	Other Production Related Machine Operators	0.8034	208.31	7.9260

910	Construction and Mining Elementary Workers	0.8145	192.67	7.7462
921	Loading and Lifting Elementary Workers	0.6603	200.36	7.8100
922	Deliverers	0.4501	198.40	7.7064
930	Production Related Elementary Workers	0.8126	211.32	7.7902
941	Cleaner and Sanitation Workers	0.7621	182.81	7.3916
942	Guards and Ticket Examiners	0.2627	222.21	7.5422
951	Domestic Chores and Infant Rearing Helpers	0.8732	183.10	7.3495
952	Food Related Elementary Workers	0.7800	206.48	7.5489
953	Sales Related Elementary Workers	0.8510	177.69	7.5439
992	Meter Reading, Money Collecting, and Parking Controlling Related Workers	0.5839	186.01	7.5462
999	Other Service Related Elementary Workers	0.7544	192.97	7.4229

Notes: 1) ESTI.is the estimate for wage elasticity with respect to working hours of occupations obtained from equation (2).

2) HOUR is the average working hours of workers employed in each occupation in 2016, and WAGE is the average log monthly wage level of workers employed in each occupation in 2016.

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