勞 動 經 濟 論 集
第41卷 第3號, 2018. 9. pp.61～93
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Decomposing the Gender Pay Gap among Doctorate Holders

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This paper examines the gender pay gap among doctorate holders in Korea to understand the determinants of this gap and control of its variation. A particular focus of this study is to seek to infer the extent to which this pay gap is the consequence of gender-based disparate treatment. The main results indicate that there is a sizeable gender pay gap even among workers with doctorate degrees, that is, very highly educated workers. Moreover, this gender pay gap cannot be largely explained by gender differences in characteristics, indicating the existence of discrimination against female doctorate holders in the Korean labor market.

Keywords: Discrimination; doctorate holders; gender; pay gap

I. Introduction

The gender pay gap has been studied intensively to investigate its magnitude and to identify its sources in the economics literature, but also remains an area of active and innovative research for a number of decades. A comprehensive review of this literature is

논문 접수일: 2018년 2월 12일, 논문 수정일: 2018년 7월 20일, 논문 게재확정일: 2018년 8월 13일
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beyond the scope of this paper. In the empirical analysis the observed pay gap between men and women generally can be explained not only by the heterogeneity of individuals and jobs in the samples but also by the possibilities to control for this heterogeneity. To capture these main differences between men and women, most prior research builds on large representative surveys with quiet heterogeneous individuals and jobs. Some researchers, however, cast doubt on that idea and attempt to use an alternative approach that is relied on smaller specialized datasets that have greater labor market details and carefully collected information on education. Indeed, numerous previous studies on the gender pay gap have mainly focused on general population with large representative datasets, but recent research has begun to examine the pay gap between the most highly educated men and women. Schulze (2015), for instance, analyzes the gender pay gap among doctoral graduates in the United Kingdom (UK) and finds a sizable overall gender pay gap, which is explained by a large pay premium for men outside academia compared to men and women in academia. Taking account of differences in endowments (such as university and employment characteristics), he also finds a major part of the gender pay gap remains discrimination factors. Using data from a large Canadian research university Doucet et al. (2012) explore the sources of the gender pay gap among university professors. They show that the effects of base pay, promotion to full professor, access to market supplements, and amounts of market supplements vary with the proportions of female faculty members within units and that the magnitude of gender differences may vary with the degree of formalization in remuneration practices. To date, however, relatively little empirical research has been conducted on highly educated group (such as doctorate holders) in South Korea (hereafter denoted as Korea).

Another set of papers explores the gender pay gap across the entire wage distribution, pursing the recognition that the gap is not uniform across this distribution. For instance, Papapetrou (2007) examines the gender pay gap according to education level of workers across the wage distribution spectrum in Greece. This research calls attention to the fact that even highly educated women who are high income earners receive much lower pay than men with similar levels of education. Taking account of a variety of personal and employment characteristics, he finds that the gender pay gap may be largely due to

discrimination against women. A recent report from the White House Council of Economic Advisers (CEA) releases the fact that the gender pay gap is particularly high among those with advanced degrees and it grows throughout women's lifetime, according to the Current Population Survey (CPS) data for the years 2010 through 2014. This report indicates that men and women have similar pay after completing professional school, but men's pay grows substantially more thereafter in the United States (US) labor market.

The present study attempts to gain an insight into the composition of the gender pay gap among doctorate holders in Korea, with a particular focus on competencies controlling for personal background and employment characteristics. Relatively very little empirical research on pay discrimination against female workers with doctoral degrees has been done in the economics literature. This paper's goal is to provide new empirical evidence delineating the extent of the gender pay gap by focusing on relatively homogenous group of doctorate holders in Korea. For this purpose, the dataset used in this analysis is taken from a nationally representative survey collecting and analyzing information on the situation of individuals who have received a doctorate degree, named KCDH (the Korean Survey of Careers and Mobility of Doctorate Holders) for the reference year 2012. The main aims of this study therefore are as follows. First, to discover whether there exists a substantial gender pay gap among this relatively homogeneous group in the Korean labor market. Second, to identify the extent to which the observed pay gap can be accounted for by discrimination as well as that which stems from observed differences between males and females in productivity characteristics.

Due to the usefulness of decomposition techniques in quantifying the contribution of multiple factors to differences in outcomes, this article implements Oaxaca-type decomposition methods in the analysis. This approach typically uses a separately estimated log wage equations for male and female workers to decompose the difference in their mean wages into a part of the pay gap that is imputable to different male and female productive characteristics (endowments) and a residual part that cannot be accounted for by these factors, which is usually referred to as discrimination. While the traditional Oaxaca-type decomposition approach suffers from some limitations, this type of technique is widely used in the literature on the gender pay gap and its simplicity makes it appealing. To address

several limitations of the standard Oaxaca decomposition method (such as index issues and selectivity bias), the current study takes into account the validity of the implemented decomposition methods (as discussed later).

While the policy debate on gender pay gap needs to focus on all levels of education, there is a particular need for attention among doctorate holders. In other words, focusing on doctorate holders has to be considered particularly important for gender pay gap studies. Doctorate holders account for a relatively small proportion of the overall population but their importance is widely appreciated. They are specifically trained for research, and as such considered to have a high potential to contribute to the advancement and diffusion of knowledge and technologies (Auriol et al., 2013). Doctorate holders are often seen as key actors behind the creation of innovation and knowledge-based economic growth, not only because they develop skills to do these tasks, but also because most of them work in research (Neumann & Tan, 2011). An innovative society depends on the employability and creativity of doctorate holders, which is why they have attracted the interest of policymakers. Until now, however, there has been relatively little information about the gender pay gap among doctorate holders in the literature. The current study, to the best of my knowledge, is the first analysis to conduct to this issue in Korea. This article therefore aims to contribute toward filling this gap in the literature.

From a policy perspective, the question whether there is a sizable gender pay gap among doctorate holders is interesting and clearly relevant in Korea. The historical development of the principle of equal pay for equal work was introduced in Korea in 1989, in a measure to end gender-based disparity. Nevertheless, a gender pay gap of considerable size has still remained in Korea and is comprehensive discussed in research and practice. According to a recent report on gender initiative by the Organization for Economic Cooperation and Development (OECD), for instance, Korea topped the list of gender pay gap among OECD nations on the basis of the year 2015. In the OECD's survey with its 36 member countries, Korea shows the worst pay gap of approximately 37% between men and women, indicating that when a man receives a wage of 1 million Korean won, a woman receives a wage of 628,000 Korean won on average. Furthermore, this gender pay gap has only improved 2% points over the past 10 years, the smallest decrease when compared with all other OECD

countries. More recently, the World Economic Forum (WEF) pointed out through the Global Gender Gap Report 2017 that Korea ranks a poor 118th out of 144 countries in the survey which examined gender parity in health, education, political empowerment, and economic opportunities. In terms of pay equality for similar work, the gender discrepancy is even more pronounced: Korea ranks at 121th.

Ⅱ. DATA

1. Data Source

The data source used in this study is drawn from Korean Survey of Careers and Mobility of Doctorate Holders (KCDH). The KCDH is an ongoing national survey of Korean doctorate holders which is representative of the entire population of doctorate holders in Korea. This survey was conducted together with the Science and Technology Policy Institute (STEPI) and Korea Statistics Promotion Institute (KSPI). The KCDH is the first project on the careers and mobility of doctoral holders which launched in 2011 aimed at addressing evidence gaps on this population which other generic statistical sources were not able to deal with. The main object of this survey is to collect data on personal, educational, labor market, employment and mobility characteristics of doctorate holders, as well as their perception and satisfaction with work. A pilot data collection for the reference year 2010 (KCHD 2010) was conducted in 2011 involving a reduced number of doctorate holders. A first large-scale data collection for the reference year 2012 (KCDH 2012) was launched in 2013 which was carried out as a part of the international Careers of Doctorate Holders (CDH) project.

For the current paper, the most recent data from the KCDH 2012 survey is used. The KCDH 2012 survey provides a comprehensive assessment of personal and educational characteristics of Korean doctorate holders as well as their labor market status. This dataset contains a wide range of questions relating to respondents' demographic, employment,

international and intra-sectoral mobility, career and earnings characteristics of advanced research qualifications at national and international level. These statistics are to answer questions about international mobility including brain drain, brain gain or brain circulation and issues about the qualitative and quantitative education-job matching in the labor market. They also deal with questions on how well the competencies of the highest educated are used by the society as well as with the attractiveness of different career paths for doctorate holders (Auriol et al., 2012). Based on the data produced by the KCDH 2012 survey, this study systemically analyzes the composition of the skilled labor force as well as labor market activity.[1)]

To get a rather homogenous sample the current study restricts to all full-time salaried workers holding doctorate degrees with nonzero working hours between the ages of 25 and 59 years that have provided complete information on the variables of interest. Self-employed and unpaid family-employed workers are not included in the analysis, because it is generally difficult to distinguish between returns to human capitals from returns to physical capital. Part-time workers are also not taken into account to avoid cases where monthly wages are affected by smaller total number of weekly working hours that is an individual worker with additional constraints in the labor supply function or strong preferences of leisure over consumption. The final sample consists of 2,749 Korean workers with doctorate degrees. Of the total respondents in the sample, 2,443 are male and 306 are female, meaning that male respondents comprise approximately 90% of the sample. The figure for female doctorate holders is much lower, indicating the sample is dominated by males. It suggests that a disproportionate number of female doctorate holders are engaged in economic activities in the Korean labor market. This may also reflect the fact that Korean women usually have lower chances of continuing their university career enrolling in doctoral courses, although women enroll in higher education more than men.[2)]

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1) More information is available on the KCDH project website : http://kchd.stepi.re.kr.

2) In the 2000s, primary and secondary educations have reached near gender parity in Korea, suggesting that men and women have equal access to higher education. Moreover, female high school students surpassed male students in the higher education entry ratio with 80.5% to 77.6% in 2010. Since 2010, female students have begun outpacing their male counterparts as the most dominant gender in terms of higher education participation and the difference is increasing.

2. Conceptual Framework and Variables

Since Becker (1957), a huge number of studies have investigated the ubiquitous phenomenon of the gender pay gap. In the literature, mostly in the field of labor economics, the gender pay gap is generally attributed to two factors: differences in labor productivity between men and women, and market discrimination against women (Gracia-Aracil, 2007). Similarly, the conceptual framework adopted in this analysis includes three major factors affecting the gender pay gap as follows:

$$PAYGAP = f(PB, EC, DISC)$$

where *PB* represents personal background like age, marital status, *EC* refers indicators of employment characteristics such as job tenure and sector of employment. The last parameter is *DISC*, which represents gender pay differences among doctorate holders with the same personal background and employment characteristics (i.e., discrimination).

The definition of the full set of variables used in the decomposition analysis is presented in Table 1. In panel *A*, the dependent variable is the natural logarithm of hourly wages. As noted above, the independent variables are classified into two domains : personal background and employment characteristics. In panel *B*, personal background includes gender (the main independent variable, with males as the reference category), age (proxy for job experience) and age squared, marital status (married vs. unmarried), region of residence (living in the capital area vs. non-capital area), field of study (natural science; engineering and technology; medical science; agricultural science; social science; humanities, with humanities as the reference category), and a dummy variable indicating where the degree is obtained (overseas vs. domestic). With the second domain in panel *C*, the characteristics of job tenure (the length of time an employee has worked for their employer) and job tenure squared, type of employment contract (permanent vs. temporary), type of organization (public sector; educational and academic institutes; private sector, with private sector as the reference category), firm size (small-sized; medium-sized; large-sized, with small-sized firm

as the reference category), and occupation (managerial and senior official; professional; semi-professional and skilled; clerks, service & sales, and semi-skilled, with clerks, service & sales, and semi-skilled occupations as the reference category) are distinguished.

〈Table 1〉 Definition of Variables

Variables	Definitions
Panel A : Dependent Variable	
LNHRW(KRW)	The natural logarithm of hourly wages (KRW: South Korean Won)
Panel B : Personal Background	
FEMALE	Dummy variable : 1 if female
AGE	Workers age in years at the time of survey
AGESQ	The square of AGE/100
MARRIED	Dummy variable : 1 if married including separated/divorced
CAPITAL	Dummy variable : 1 if residence is in the capital area or territory
OVERSEAS	Dummy variable : 1 if doctoral degrees overseas
Field of Study	
SCI	Dummy variable : 1 if majored in natural science
ENGI	Dummy variable : 1 if majored in engineering and technology
MEDI	Dummy variable : 1 if majored in medical science <Reference group>
AGRI	Dummy variable : 1 if majored in agricultural science
SOCIAL	Dummy variable : 1 if majored in social science
HUMAN	Dummy variable : 1 if majored in humanities
Panel C : Employment Characteristics	
TENURE	Workers job tenure in years at the time of survey
TENURESQ	The square of *TENURE*/100
PERT	Dummy variable : 1 if permanent employment contract
Type of Organization	
PUBLIC	Dummy variable : 1 if employed in public sector
ACADEMIC	Dummy variable : 1 if employed in educational and academic institutes
PRIVATE	Dummy variable : 1 if employed in private sector <Reference group>
Firm Size	
SMALL	Dummy variable : 1 if a firm has less than 300 employees <Reference group>
MEDIUM	Dummy variable : 1 if a firm has 300 to 1,000 employees
LARGE	Dummy variable : 1 if a firm has more than 1,000 employees
Occupation	
OCC1	Dummy variable : 1 if Managerial and senior official occupations
OCC2	Dummy variable : 1 if Professional occupations
OCC3	Dummy variable : 1 if Semi-professional and skilled occupations
OCC4	Dummy variable : 1 if Clerks, service & sales, and semi-skilled occupations <Reference group>

〈Table 2〉 Summary Mean Statistics

Variables	Male	Female
Panel A : Dependent Variable		
LNHRW (The natural logarithm of hourly wages)	10.618	10.348
Panel B : Personal Background		
AGE (Workers age; years)	50.809	46.958
AGESQ (The square of *AGE*/100)	26.401	22.740
MARRIED (Married)	0.964	0.810
CAPITAL (Living in the capital area)	0.409	0.431
OVERSEAS (Doctoral degrees overseas)	0.245	0.183
Field of Study		
SCI (Natural science)	0.163	0.229
ENGI (Engineering and technology)	0.425	0.078
MEDI (Medical science)	0.117	0.275
AGRI (Agricultural science)	0.043	0.026
SOCIAL (Social science)	0.187	0.258
HUMAN (Humanities)	0.065	0.134
Panel C : Employment Characteristics		
TENURE (Job tenure; years)	15.070	10.863
TENURESQ (The square of *TENURE*/100)	3.201	2.087
PERT (Permanent employment contract)	0.940	0.827
Type of Organization		
PUBLIC (Public sector)	0.210	0.206
ACADEMIC (Educational and academic institute)	0.551	0.657
PRIVATE (Private sector)	0.239	0.137
Firm Size		
SMALL (Small-sized firm)	0.290	0.419
MEDIUM (Medium-sized firm)	0.312	0.274
LARGE (Large-sized firm)	0.398	0.307
Occupation		
OCC1 (Managerial and senior official occupations)	0.033	0.023
OCC2 (Professional occupations)	0.891	0.938
OCC3 (Semi-professional and skilled occupations)	0.061	0.029
OCC4 (Clerks, service & sales, and semi-skilled occupations)	0.015	0.010
Sample Size (Observations)	2,443	306

3. Descriptive Overview

Table 2 provides a descriptive overview of a number of characteristics of male and female doctorate holders in Korea. As can be seen from panel *A*, female doctorate holders

earn on average less than their male counterparts. The log of hourly wages is 10.618 for males and 10.348 for females, yielding a gender pay gap of approximately 27%. It suggests that full-time working females with doctoral degrees receive on average nearly 27% lower hourly wages than their male counterparts. That difference is relatively greater than the gender pay gap in many western countries. The article by the Statistics Explained, for instance, has shown just how huge the gender pay gap among Korean doctorate holders really is. For the economy as a whole, in 2015, women's gross hourly earnings were on average 16.3% below those of men in the European Union (EU-28) and 16.8% in the euro area (EA-19). Across member countries, the gender pay gap varied by 21% points, ranging from 5.5% in Italy and Luxembourg to 26.9% in Estonia.[3] Given women's higher education participation rate is higher than men's in Korea, the result presented here points out that women's higher education has had little influence in reducing the gender pay gap in the workplace and there is a considerable disparity in what male and female workers with doctoral degrees earn in Korea. These may also provide convincing evidence that relative position of female doctorate holders are inferior to that of their male counterparts in the Korean labor market, at least in terms of wage levels. Indeed, Korean women generally experience a weaker position in different aspects of their participations in the labor market because of the male-dominated social and economic structure, for example (Park, 2016).

The gender pay gap is maintained by many forces and mechanism, which in general include the choice of field of study and the education, economic determinants, cultural and social and customs, and discrimination aspects (Triventi, 2013). Although this study uses a rather homogeneous sample of workers, a portion of the gender pay gap might be explained by gender differences in some personal background and employment characteristics. The results for personal background and employment characteristics of the sample used in this analysis are summarized in panels *B* and *C*, respectively. On the whole, the data suggests that these male and female doctorate holders are not quite similar. Several notable differences are worthy of note because a given variable can be relevant mediator of the

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3) Statistics Explained is an official Eurostat website presenting statistical topics in an easily understandable way. For details, see http://ec.europa.eu/eurostat/statistics-explained/index.php/Gender_pay_gap_statistics.

gender wage gap only if it is distributed unevenly across males and females and if it substantially affects wages.

As shown in panel *B*, statistics indicate that compared with their male counterparts, female doctorate holders are younger, suggesting that male doctorate holders are somewhat more experienced than their female counterparts in the Korean labor market. Since the KCDH 2012 survey has no data on years of work experience, *AGE* and *AGESQ* are proxies for a worker's labor market experience in this analysis.[4] Thus, *AGE* and *AGESQ* are particularly important factors in explaining some amount of the observed gender pay gap. In many previous studies, the subject of the academic degree held has explained some amount of the gender pay gap (Machin & Puhani, 2003). As noted, this study distinguishes six different fields of study in the analysis (natural science; engineering and technology; medical science; agricultural science; social science; humanities). The most striking difference between men and women is found in the field of engineering and technology (*ENGI*): 42.5% for men vs. 7.8% for women. This finding may indicate that women usually major in less remunerative areas such as the liberal arts rather than engineering and technology fields. In such circumstance, gender differences in the fields of doctoral studies can be found to be one of the key determinants the gender pay gap among doctorate holders in the Korean labor market.

In panel *C*, employment characteristics are also taken into account. Average job tenure (*TENURE*) for both gender amounts to more than 10 years, suggesting that employment relationship for doctorate holders is relatively stable in the Korean labor market. However, female doctorate holders have less job tenure than their male counterparts. The average job tenure for female workers with doctoral degrees is about 10 years and about 15 years for men. With respect to a permanent employment contract (*PERT*), the proportion of permanent contracts is higher among male doctorate holders compared to their female counterparts. Among three types of organizations (private sector; public sector; educational and academic institutes), female doctorate holders are more present in educational and academic institutes

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4) In the absence of statistics on pre-work education in the KCDH 2012, this paper cannot calculate workers' labor market experience for the complete data and so this study use *AGE* as a proxy.

(*ACADEMIC*) than their male counterparts, whereas male doctorate holders are more likely to be hired in private sector employment (*PRIVATE*) compared to their female counterparts. More male doctorate holders tend to pursue private sector employment, which subsequently pay more in the Korean workplace. These data may indicate the fact that male and female doctorate holders disproportionately are employed different types of organizations, suggesting that employment sectors in the Korean labor market remain segregated by gender. Firm size is measured by the number of workers in three categories (small-sized; medium-sized; large-sized). The data shows that male doctorate holders are to some extent more likely to be employed in medium-sized (*MEDIUM*) and large-sized firms (*LARGE*) than female doctorate holders. The pay level (i.e., the average salary paid to workers) is generally higher in medium-sized and large firms than in small-sized firms overall. Similarly, managerial and senior official occupations (*OCC1*) employs relatively few female doctorate holders, although most doctorate holders are working for professional occupations (*OCC2*). According to these descriptions, female doctorate holders face harder labor market conditions than their male counterparts in the Korean labor market.

III. Empirical Model and Methodology

1. Estimating the Gender Pay Gap and Sample Selection Bias

Initially the current study focuses on estimating the gender pay gap as the average difference between men's and women's log hourly wages to understand the sources of this gap and control of its variation in the Korean labor market. To determine statistically significant personal background and employment characteristics that affect the workers' wages, the regression model runs the Mincerian wage equation, where the log hourly wage is the dependent variable, female is a key independent variable and indicators discussed in the earlier section. The regression specification employed in this empirical analysis is of the following general form:

$$\ln Y_i = \alpha_i + \beta Female + \gamma X_i + \mu_i$$

where *i* index individual workers holding doctoral degrees. The dependent variable $\ln Y_i$ is the log hourly wage of the individual worker *i*. Female is a key independent variable indicating if an individual is female, 0 otherwise. X_i is a vector of regressors including personal background and employment characteristics. γ is a vector of unknown parameters to be estimated. μ_i is a conventional mean zero disturbance. The variable of interest is the coefficient on the gender dummy variable, β, which indicates the gender pay gap conditional on the independent variables.

To estimate the gender pay gap, the standard OLS estimation method is applied in the analysis. Given that not all doctorate holders are employed in the labor market, and that labor force participation varies usually according to gender, there is some concern about a selection bias problem in the estimation of gender wage gap with standard regression models. Even if this selection bias problem should be less marked in a sample of doctorate holders, it is still useful to consider this potential issue in general. Women self-select into work, and one can observe wages for women who are employed in the data, and employed women are a non-random subgroup of all women. If women made the decision to participate in the labor market randomly, it is possible to ignore that not all wages are observable and use a conventional OLS procedure in the analysis. However, such an assumption of random participation is unlikely to hold in practice, because women who would have lower wages may be unlikely to choose to work, and thus the sample of observed wages is biased upward. In this paper, I expect to find evidence of positive selection of female doctorate holders into the labor force, meaning that female workers with doctoral degrees earn more on average than female doctorate holders who are currently not working would if they would decide to become employed.

The most common approach to correct selection bias involves a class of estimators known as Heckman selection models (Heckman 1976, 1979), sometimes called the Heckit models. This paper makes use of the Heckman two-step approach over the maximum likelihood model because the latter relies more heavily on normality assumptions. To avoid

that the identification of the model relies only on distributional assumptions, a set of exclusion restrictions is included in regression models, namely marital status and mother's educational attainment.[5] Exclusion restrictions are variables that affect the selection process (the first stage) as they contribute to the determination of the propensity to work, but they are uncorrelated any other determinants of wages. The Heckman two-step model is based on the recognition that the sample selection problem is really an example of omitted variable bias and assumes that there exists an underlying regression relationship, given by the following regression equation:

$$Y_i = \beta X_i + \mu_{1i}$$

In the regression equation the value of Y_i, however, is not always observed. Rather, the dependent variable for observation i is observed if the condition stated by the selection equation below holds:

$$Y_i = \beta X_i + \mu_{1i}$$

$$\text{where } \mu_1 \sim N(0, \delta),\ \mu_2 \sim N(0, 1),\ Corr(\mu_1, \mu_2) = \rho$$

If the error term for the wage equation (μ_i) and the error term for the selection equation (μ_e) are correlated ($\rho \neq 0$), then standard regression techniques applied to the first equation yield biased results. Heckman selection models provide consistent, asymptotically efficient estimates for all the parameters in such models.

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5) In the selection equation, the marital status variable is a dummy (*MARRIED*), which takes one if the individual is married, and zero otherwise (married vs. unmarried). The highest level of education attained by mothers is captured by using a set of three dummy variables as follows : Less than high school graduates and high school dropouts (*HSDROP*); high school diploma (*HSCHOOL*); 2-year college degree or above (*COLLEGE*).

2. Standard Decomposition

To gain a better view into the composition of the gender pay gap, this paper considers methods of decomposing pay inequality into contributing factors to assess the contributions of different variables to the gender pay gap. The basic idea is to explain the distribution of the outcome variable in question by a set of factors that varies systematically with socio-economic status or employment characteristics. For instance, variations in pay may be explained by variations in age, field of study, and job tenure. Regarding the gender pay gap, there are differences in the groups' average human capital levels (mainly in education, job experience, and training) and discrimination in the marketplace (measured by different rates of return to human capital) is also generally prevalent. Blinder (1973) and Oaxaca (1973) were the first to suggest a methodology for estimating the contributions of human capital differences and discrimination to the gender pay gap. The core technique is quite straightforward. After fitting separate regression for men and women, the predicted gap in the means of an outcome variable between both gender groups is decomposed into a component that is explained by group differences in productivity characteristics and in another component that cannot be explained by these variables, usually referred as "discrimination" or "pay structure".

In this study males (*m*) and females (*f*) identify the two separate groups, log of hourly wages is the dependent variable (*Y*), and several variables indicating personal background and employment characteristics are predictors. The question is how much of the mean outcome difference:

$$\overline{Y}_m - \overline{Y}_f = \sum \beta_m \overline{X}_m - \sum \beta_f \overline{X_f}$$

where $\overline{Y}$ denotes the expected value of the outcome variable, is accounted for by group differences in the predictors. A standard decomposition of Blinder (1973) and Oaxaca (1973) is

$$\overline{Y}_m - \overline{Y}_f = (\overline{X}_m - \overline{X}_f)'\widehat{\beta_m} + \overline{X}_f'(\hat{\beta}_m - \hat{\beta}_f)$$

This decomposition assumes that males structure (*m*) is the norm. The standard decomposition method is to adopt one of the estimated pay structures as the nondiscriminatory norm. Often researchers select the wage structures for the group of workers believed to be dominant in the labor market. One implication of this procedure is that all of the discriminatory differentials are ascribed to underpayment of the subordinate group rather than to overpayment of the dominant group (Neuman & Oaxaca, 2004). The standard decomposition method adopts the male wage structure as the nondiscriminatory norm in the analysis, although alternative choice for nondiscriminatory wage standard can be the female wage structure also. Accordingly, the first component $(\overline{X}_m - \overline{X}_f)'\widehat{\beta_m}$ represents the outcome differential that is explained by group differences in the predictors and the second term $\overline{X}_f'(\hat{\beta}_m - \hat{\beta}_f)$ represents the unexplained differential. In some contexts, this term is interpreted as a measure of discrimination.

3. Generalized Decomposition

The standard decomposition technique estimates only relative differences. In the case of discrimination estimates, one does not know how much of the unexplained (discriminatory) pay gap arises from favoritism toward one group of workers and how much arises from pure discrimination against the other group. To resolve this identification issue, following Oaxaca and Ransom (1994), the nondiscriminatory wage structure is estimated from a pooled sample of the two demographic groups in this analysis. This more general approach allows the discrimination component to be further disaggregated into overpayment (favoritism) and underpayment (pure discrimination) as shown below.[6] Let β^* be such a nondiscriminatory coefficient factor. It is based on assumption that discrimination can be negative (against one group) or positive (in favor of other group). The outcome differences

6) Generalized wage decompositions are also found in Reimers (1983), Cotton (1988), and Neumark (1988).

can be decomposed into explained (Q) and unexplained (U) part of the wage gap :

$$\overline{Y}_m - \overline{Y_f} = Q + U$$

where the first component Q,

$$Q = (\overline{X}_m - \overline{X}_f)'\beta^*$$

is the part of the outcome differential that is explained by group differences in the magnitudes of the determinants of the outcome (the quantity effect from productivity differences between analyzed groups). And the second component U,

$$U = \overline{X}_m'(\beta_m - \beta^*) + \overline{X}_f'(\beta^* - \beta_f)$$

is the unexplained part that describes average discrimination in favor of group in relative better situation ($\overline{X}_m'(\beta_m - \beta^*)$), and average discrimination against group in relatively worse situation ($\overline{X}_f'(\beta^* - \beta_f)$). This is usually attributed to discrimination, but it also captures all potential effects of differences in unobserved variables.

4. Decomposition with Selectivity Correction

This section considers how decompositions are affected by corrections for sample selection. As noted earlier, working male and female doctorate holders may not be a random sample of the working age population. If a female doctorate holder knows that she cannot find a job with high paying in the Korean labor market, for instance, she could choose to work in other countries where she is rewarded appropriately. Female doctorate holders with very high ability are more likely to do that, and this determines the possibility

to observe their wages in the data. This sample selectivity may impart biases in wage equations unless the sample selection effects are taken into account when estimating the wage equations. Since the current paper is interested in the gender pay gap among doctorate holders, sample selection corrections are integrated into standard decomposition methods discussed earlier. There are several proposed methods to handle the selection correction term within the decomposition in the literature (e.g., Dolton & Makepeace, 1986; Neuman & Oaxaca, 2004). Following Neuman and Oaxaca (2004), this study treats the gender differences in selectivity as a third separate component of the wage decomposition as below (assuming the m wage structure is the norm):

$$
\begin{aligned}
R &= \overline{Y}_m - \overline{Y}_f = (\overline{X}_m{}'\hat{\beta}_m + \hat{\theta}_m\hat{\lambda}_m)' + (\overline{X}_f{}'\hat{\beta}_f - \hat{\theta}_f\hat{\lambda}_f) \\
&= \overline{X}_f{}'(\hat{\beta}_m - \hat{\beta}_f) + (\overline{X}_m - \overline{X}_f)'\hat{\beta}_m + (\hat{\theta}_m\hat{\lambda}_m - \hat{\theta}_f\hat{\lambda}_f) \\
&= Discrimination + Endowments + Selectivity
\end{aligned}
$$

where $\hat{\theta}$ is an estimate of (δ_{12}/δ_2) and $\hat{\lambda}$ is an estimate of the Inverse Mills Ratio (IMR).

To decompose the gender pay gap, first Heckman two-step method is used to correct for selection bias and then the selection correction is integrated into the standard Oaxaca decomposition method. This decomposition approach is implies to identify the overall contribution of selection component to the gender pay gap as a category apart from discrimination and endowments effects. The first two terms are the familiar discrimination and human capital endowments components, and the last term measures the contribution of selection effects to the observed gender pay gap.[7)]

7) A potential critical issue is how to analyze and interpret this last term. For more information, see Neuman and Oaxaca (2004).

IV. Results and Discussion

1. Estimations of the Wage Equations

This section examines whether and to what extent doctorate holders' personal background and employment characteristics affect their log of hourly wages. The estimation strategy in the analysis involves increasing the complexity of the models, by moving from OLS (ordinary least squares) regression to Heckman selection models. OLS regression has been estimated on the whole sample (i.e., the pooled sample of male and female doctorate holders) and Heckman selection model includes males and females, respectively. The estimation results based on OLS regression and the Heckman's two-step procedure are shown in Tables 3 and 4, respectively. The overall findings from Tables 3-4 are consistent with the results found in conventional wage estimations. Moreover, the results from OLS regression and Heckman selection model do not differ much. For simplicity, main findings from the former OLS estimation are presented in this section.

As shown in Table 3, while coefficients estimates are presented based on a large number of control variables, most estimates are statistically significant. Regarding personal background in panel *A*, it is evident from the estimated result that there exists a significant pay gap between male and female doctorate holders in Korea. The result shows that female workers with doctorate degrees (*FEMALE*) are paid less than their male counterparts, suggesting that female doctorate holders are 10.9% less than their male workers with the same level of education who are working in jobs.[8] Age(*AGE*) and age squared (*AGESQ*) show the standard concave pattern with wages. This indicates that strong age effects exist with positive and negative signs on the linear and quadratic terms. Living in the capital area (*CAPITAL*) has positive significant effects on wages, which suggests that the capital

8) For dummy variables, $[e^{(\text{the coefficients of variables})}-1] \times 100$ yields the percent change in wages.

〈Table 3〉 Gender Pay Gap among Doctorate Holders

Variables	Mean	S.E.
Panel *A* : Personal Background		
FEMALE (*Female Workers*)	-0.115	(0.045)**
AGE (Workers age; years)	0.084	(0.021)***
AGESQ (The square of *AGE*/100)	-0.063	(0.022)***
MARRIED (Married)	0.051	(0.066)
CAPITAL (Living in the capital area)	0.072	(0.029)**
OVERSEAS (Doctoral degrees overseas)	0.015	(0.033)
Field of Study		
SCI (Natural science)	-0.128	(0.050)**
ENGI (Engineering and technology)	-0.078	(0.044)*
AGRI (Agricultural science)	-0.131	(0.077)*
SOCIAL (Social science)	-0.077	(0.048)
HUMAN (Humanities)	-0.067	(0.062)
Panel *B* : Employment Characteristics		
TENURE (Job tenure; years)	0.011	(0.006)*
TENURESQ (The square of *TENURE*/100)	-0.028	(0.017)*
PERT (Permanent employment contract)	0.273	(0.057)***
Type of Organization		
PUBLIC (Public sector)	-0.267	(0.043)***
ACADEMIC (Educational and academic institute)	-0.180	(0.039)***
Firm Size		
MEDIUM (Medium-sized firm)	0.067	(0.035)*
LARGE (Large-sized firm)	0.092	(0.033)***
Occupation		
OCC1 (Managerial and senior official occupations)	0.356	(0.128)***
OCC2 (Professional occupation)	0.320	(0.105)***
OCC3 (Semi-professional and skilled occupations)	0.126	(0.117)
Constant	7.480	(0.505)***
Sample Size (Observations)	2,749	
R-squared(R2)	0.139	
Adjusted R2	0.133	
F (Prob>F)	20.98(0.000)	

area continues to be characterized by higher cost of living; increased demand for labor; and expanded job opportunities-all of which contribute to increased wage rates. In terms of fields of study, three variables are negative and statistically significant effects on wages given the omitted group (*MEDI*), with two exception - doctorate holders of the social science and humanities major.

Turning to employment characteristics in panel *B*, the findings are also in line with the previous studies in the literature as follows. Job tenure (*TENURE*) is associated with higher wages, which indicates that wages increase with job tenure. This finding is consistent with the typical predictions that people with higher levels of human capital accumulation are paid more than those with lower levels of human capital traits (i.e., the wage premium). As would be expected, the indicator for the permanent employment (*PERT*) accounts for the wage premium. Given the omitted category (*PRIVATE*; working in private sector), there exist a sizable negative wage differential in favor of doctorate holders working in the public sector (*PUBLIC*) or educational and academic institutes (*ACADEMIC*). The wage level is significantly large who are working in relatively large-sized firms (*MEDIUM*, *LARGE*). In terms of occupation, all three variables are positive and statistically significant and of plausible relative magnitudes given the reference group (Clerks, service & sales, and semi-skilled occupations; *OCC4*).

Before discussing the results of decompositions in the following section, it is worth briefly summarizing the results of the Heckman selection model. Table 4 provides selectivity corrected estimates based on the Heckman's two-step method.[9] The estimation results are presented in column (1) for male doctorate holders and column (2) for female doctorate holders, respectively. When the OLS model is rerun with the inclusion of the Heckman correction term(Inverse Mill's Ratio; IMR), the magnitude of the coefficients change as well as their standard errors, but the over all patterns are not dramatically different. Similarly to the results of Table 3, the results of the regression in column (1) for male doctorate holders conform to the results found in numerous other previous studies in the economics literature. In column (2) for female doctorate holders, a relatively small number of estimates are statistically significant from zero or magnitude of their coefficients is very small. However, all findings still have the same signs with the results for male doctorate holders in column (1). This lack of statistically significance may in part be explained by the

9) The estimates of the Probit regressions on the labor force participation equation (the first stage) are reported in *Appendix*. The predictors in this selection model are age, marital status, mother's educational attainment, and whether capital area or non-capital area resident. The model is run for males and females, and the IMR was calculated to provide a Heckman correction term.

relatively small number of observations of female doctorate holders. Although potential sample selection bias seems to be particularly important female doctorate holders in this study, the Heckman correction term (IMR) in both male and female samples is not statistically significant, suggesting that selection bias is not a major issue with this model.

〈Table 4〉 Selectivity Corrected Estimates of the Gender Pay Gap

Variables	Male (1)	Female (2)
Panel *A* : Personal Background		
AGE (Workers age; years)	0.124(0.040)***	0.244(0.241)
AGESQ (The square of *AGE*/100)	-0.107(0.042)***	-0.249(0.270)
MARRIED (Married)	0.017(0.085)***	0.017(0.433)
CAPITAL (Living in the capital area)	0.085(0.030)***	0.013(0.171)
OVERSEAS (Doctoral degrees overseas)	0.036(0.034)**	0.040(0.161)
Field of Study		
SCI (Natural science)	-0.206(0.050)***	-0.480(0.199)***
ENGI (Engineering and technology)	-0.136(0.040)***	-0.375(0.203)***
AGRI (Agricultural science)	-0.242(0.076)***	-0.546(0.266)**
SOCIAL (Social science)	-0.165(0.047)***	-0.302(0.404)
HUMAN (Humanities)	-0.186(0.064)***	-0.363(0.193)**
Panel *B* : Employment Characteristics		
TENURE (Job tenure; years)	0.001(0.002)**	0.008(0.023)
TENURESQ (The square of *TENURE*/100)	-0.000(0.000)**	-0.007(0.077)**
PERT (Permanent employment contract)	0.249(0.056)***	0.243(0.129)***
Type of Organization		
PUBLIC (Public sector)	-0.134(0.037)***	-0.256(0.160)
ACADEMIC (Educational and academic institute)	-0.248(0.045)***	-0.294(0.132)**
Firm Size		
MEDIUM (Medium-sized firm)	0.070(0.036)***	0.117(0.153)
LARGE (Large-sized firm)	0.086(0.034)***	0.167(0.150)
Occupation		
OCC1 (Managerial and senior official occupations)	0.467(0.125)***	0.913(0.432)***
OCC2 (Professional occupations)	0.370(0.101)***	0.879(0.105)***
OCC3 (Semi-professional and skilled occupations)	0.199(0.114)***	0.637(0.338)**
Constant	6.686(0.915)***	5.159(1.795)***
Inverse Mills Ratio(*Lambda*)	0.702	1.364
Sample Size (Observations)	2,509	348
Wald 2	333.06	25.59
F (Prob>F)	0.000	0.000

2. Decomposing the Gender Pay Gap

After gender pay inequality is measured, a natural next step is to seek to explain them. In Tables 3-4, the estimation results of the wage regression models do not allow one to identify and quantify the different sources of the gender pay gap. On the basis of the models discussed in the previous section, the current study decomposes the gender pay gap among doctorate holders in log hourly wages. To gain a better understanding of the composition of the pay gap to the sample of male and female doctorate holders, this gap is decomposed using Oaxaca-type decomposition methods discussed earlier.

Three models are estimated to check the sensitivity of the results to different decomposition methods in the analysis. The first model implements the standard Oaxaca decomposition using the male wage structure (labeled as "Decomposition #1"). The second model applies generalized decomposition, which choose a linear combination of the separately estimated male and female wage regression using the pooled sample of male and female workers with doctoral degrees (labeled "Decomposition #2"). These two approaches without selectivity correction decompose mean differences in labor market outcomes by two groups based on linear regression models in a counterfactual manner. The actual gender pay gap is divided into an explained component ("Endowments") which is accounted for by observable characteristics that are expected to influence remuneration and an unexplained component ("Discrimination") which captures what remains after adjusting for these observable characteristics.[10] To show how much difference it makes when selectivity is not taken into account and when it is taken into account, the third model implements the selectivity corrected decomposition (labeled as "Decomposition #3"). This model decomposes the gender pay gap into the following three parts. The "Endowments" component reflects the mean increase in women's wage level if they had the same productivity characteristics as men. The "Discrimination" component quantifies the change in women's wages when applying the men's coefficients to the women's characteristics. The "Selectivity" component measures the contribution of selection effects to the observed gender pay gap.

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10) Indeed, the "Discrimination" component includes labor market discrimination, measurement error, and also factors unaccounted, etc.

〈Table 5〉 Decomposing the Gender Pay Gap

Panel *A* : Gender Pay Gap		
Mean prediction of log hourly wages	Male	10.618
	Female	10.348
Overall (unadjusted log pay gap)		0.270
Panel *B* : Decompositions of the Gender Wage Gap		
Decomposition #1 (male wage structure)	Endowments	0.154(57.0%)
	Discrimination	0.115(42.6%)
	Selectivity	0.000(00.0%)
Decomposition #2 (pooled sample wage structure)	Endowments	0.169(62.6%)
	Discrimination	0.101(37.4%)
	Selectivity	0.000(00.0%)
Decomposition #3 (selectivity corrected decomposition)	Endowments	0.174(64.4%)
	Discrimination	0.113(41.9%)
	Selectivity	-0.017(6.3%)
Sample Size (Observations)		2,749

The estimation results of the gender pay gap among doctorate holders are provided in Table 5. To attain an overall picture of the gender pay gap, the first and second rows in panel *A* provide the mean prediction of log hourly wages by groups and the third row, labeled as “Overall”, indicates the observed gender pay gap yielding from the first and second rows. Panel *B* reports the results of Oaxaca-type decomposition methods. As described earlier, Oaxaca-type decomposition technique determines the percentage of the pay gap that cannot be explained on the basis different characteristics between men and women with the same level of education level (i.e., discrimination).

As regards the actual gender pay gap in panel *A*, the analysis conducted on the overall sample indicates the existence of a sensible gender difference in wages: an estimated gender pay gap of approximately 27% among doctorate holders. The mean of log of hourly wages (*LNHRW*) is 10.618 for men and 10.348 for women, yielding a pay gap of 0.270. It suggests that male doctorate holders earn approximately 27% more than their female counterparts. In other words, female doctorate holders earn approximately 73% of the remuneration of male doctorate holders in the Korean labor market. This figure is somewhat interesting when comparing the size of the gender pay gap across countries. Based on OECD/UNESCO Institute for Statistics/Eurostat data collection on careers of doctorate

holders 2010, descriptive statistics show that female doctorate holders earn less than their male counterparts and in some countries the difference is close or above 25%. Israel's average wage difference between male and female doctorate holders stood at approximately 32%, the highest among the countries surveyed. United States, Netherlands, and Russian Federation had over 20%. Portugal had the narrowest wage gap with approximately 8%, followed by Denmark with approximately 10%. These results suggest that about 27% of the gender pay gap among doctorate holders in Korea is relatively larger than the pay gap in other developed countries.

Panel *B* presents the decomposition results performed after standard OLS regression model for the various comparisons. There are three decompositions corresponding to each comparison. The results indicate that endowment effect accounts from 57.4% to 64.4% of the pay gap, and the discrimination effect accounts from 37.4% to 42.6% of the pay gap. When employment probabilities are not taken into account (no selectivity correction), difference in characteristics (endowment effect) explain between 57.4% and 62.6% of the pay gap among Korean doctorate holders. The "Decomposition #1" based on the male pay structure shows that the "Endowments" component accounts for approximately 57%. Using the pooled coefficients over both gender groups as an estimate for the nondiscriminatory parameter vector, the "Decomposition #2" approach suggests a higher proportion of the pay gap accounted for approximately 64%. According to the "Decomposition #3" approach, selection contributes to a narrowing of the observed gender pay gap. This indicates that the observed gender pay gap underestimates the differences in the selection corrected pay between two groups, suggesting that the estimated pay for female doctorate holders in the traditional Oaxaca-type decomposition technique without considering selection bias was upward biased.

In Table 5, the results suggest that male doctorate holders, on average, have more characteristics with higher wages than their female counterparts in the Korean labor market. However, the figures also show that this gender pay gap is significantly attributable to the unexplained component. Although not all of the unexplained gaps attributed to residual discrimination, this gender pay gap cannot be largely explained by differences in characteristics between male and female doctorate holders. It indicates that unobservable or

unproductive characteristics have an important explanatory power in the variation of the gender pay gap, suggesting existence of discrimination against female doctorate holders in Korea. More specifically, this article shows that female doctorate holders earn, on average, approximately 27% less than their male counterparts in the Korean labor market. As regards the extent to which this pay gap represents the discrimination factor (unexplained part of the differences), a non-negligible proportion of the gender pay gap - at least 37% but no more than 43% on average - cannot be explained by recourse to a large range of personal background and job characteristics. A large part of the gender pay gap among doctorate holders in the Korean labor market is simply due to women with doctoral degrees being female, suggesting that discrimination plays a major part.

To reduce the gender pay gap and ensure equal pay across both genders, it is important to understand why the gender gap exists. In this analysis over 50% of the gender gap can be explained by certain measurable or productive factors such as sectoral segregation channeling women into low value added jobs. Overall wage-setting institutions and structures which may be designed with a focus on workers in male-dominated sectors may also shape the gender wage gap. Most importantly, there are underlying causes of the gender wag gap that are difficult to quantify such as gender-based stereotypes about the value of women's work (i.e., under-evaluation of women's work), discriminatory practices, professional networks that are more robust for men than for women, and hesitancy on the part of women to aggressively negotiate for raises and promotions. Family behavior patterns and the view of women as economic dependents may also influence the gap. This paper suggests that these unobserved factors may account for approximately 40% of the gender wage gap among doctorate holders in Korea.

3. Detailed Decomposition

As noted, the decomposition results show more than 50% of the estimated size of the pay gap could be explained differences in personal background and employment characteristics. To identify which variables are more important in accounting the gender pay gap, the results of the detailed decomposition analysis are reported in Table 6. This

〈Table 6〉 Detailed Decomposition Analysis: Gender Pay Gap Explained

Variables	Log Points	%
Panel *A* : Personal Background		
Age (*AGE; AGESQ*)	0.020	7.3
Marital Status (*MARRIED*)	0.004	1.3
Region (*CAPITAL*)	0.006	2.3
Doctoral Degrees Abroad (*OVERSEAS*)	0.005	1.9
Field of Study (*SCI; ENGI; AGRI'; SOCIAL; HUMAN*)	0.042	15.6
Subtotal	***0.077***	***28.4***
Panel *B* : Employment Characteristics		
Job tenure (*TENURE; TENURESQ*)	0.015	5.7
Permanent employment contract(*PERT*)	0.011	4.2
Type of Organization (*PUBLIC; ACADEMIC*)	0.031	11.3
Firm Size (*MEDIUM; LARGE*)	0.022	8.3
Occupation (*OCC1; OCC2; OCC3*)	0.013	4.7
Subtotal	***0.092***	***34.2***
Total Explained Gap	**0.169**	**62.6**
Total Unexplained Gap	0.101	37.4
Total Pay Gap	0.270	100

approach shows the contribution of each variable to the gender pay gap among the sample of doctorate holders in the Korean labor market. Since the overall results using different decomposition techniques are similar, the results from the "Decomposition #2" are presented here. The Decomposition #2 based on Oaxaca and Ransom (1994) model is the most widely used in the literature and it is the one employed here. Moreover, the most conservative measures of the proportion of the gross pay gap due to discrimination are provided by the "Decomposition #2", as well as the largest values for the component attributable to the characteristics.

It is interesting to note that the relative contribution of the single variables is rather heterogeneous within the following two broad conceptual domains: personal background and employment characteristics. Fields of study have the strongest role among personal background. Regarding employment characteristics, one of the most important factors explaining pay differences seems to be type of organization of women in less remunerative sectors such as public organizations or educational and academic institutions. With respect to personal background in panel *A*, the most important aspects are fields of study, which

account for 15.6%. All else being constant, if women's distribution of fields of study changed to be similar to that of men, the gender pay gap explained would be reduced by approximately 16%. Age, marital status (married vs. unmarried), living in the capital area, and doctoral degrees overseas account for the remaining approximately 13% of the explained component. As regards employment characteristics in panel *B*, the most relevant endowments are type of organization (approximately 11%), followed by firm size variables (approximately 8%) job tenure (approximately 6%) and a permanent employment contract (approximately 4%).

V. Summary and Conclusion

The aim of this paper is to examine whether there is a gender pay gap among doctorate holders in Korea and the composition of the gender pay gap, with a particular focus on competencies controlling for personal background and job characteristics. To this end, the gender pay gap is estimated in relation to log of hourly wages, using both a conventional OLS regression analysis in which selection bias is a problem and Heckman's two-step approach as a method of sample selection bias correction. Then, Oaxaca-type decomposition techniques are applied to examine the extent to which this pay gap is the consequence of gender-based disparate treatment. The Oaxaca-type decomposition approach is particularly useful to investigate how much of the gender pay gap cannot be explained by the model, by quantifying the contribution of multiple factors to wage differences. This unexplained portion of the differences is generally interpreted as resulting from discriminatory differences in the male and female wage structure. The empirical analysis uses data from the Korean Survey of Careers and Mobility of Doctorate Holders for the reference year 2012 (KCDH 2012), which was presented by Science and Technology Policy Institute (STEPI).

Despite the acknowledged shortcomings of Oaxaca-type decompositions, which are fairly sensitive to the quality of the information available and the estimation model used, the results presented in this paper provide some interesting insights as follows. This study finds that there is a sizeable gender pay gap even among workers with doctorate degrees, that is,

very highly educated workers. Furthermore, the results show that the gender pay gap among doctorate holders in the Korean labor market is significantly attributed to attributable to the unexplained component. It indicates that female doctorate holders suffer a substantial wage penalty in terms of the portion of their pay attributable to differences concerning returns (non-productive characteristics) in the Korean labor market, suggesting that the effects of discrimination play a substantial role in explaining the observed gender pay gap among Korean doctorate holders.

It is absolutely imperative that Korea work towards correcting the gender pay gap. Women are now more likely to have college degree than men and make up nearly half of the total workforce in Korea. Yet, on average, women still earn considerably less than men, even when they have similar levels of education. There are generally four important factors that cause the gender pay gap in the Korean labor market as follows: occupational segregation, different patterns of labor market participation, stereotypical view about gender roles, and the remaining unexplained portion such discrimination. In particular, the social norm or gender stereotypes cause the gender pay gap in Korea even after controlling the socio-economic variables. As pointed out by Park (2016), Korean women tend to invest more time in household responsibilities in their own families. A number of women quit their jobs for childcare are to blame for the gender pay gap because this reduces the number of high-income female wage earners. Given that women tend to stay home due to household responsibilities occur due to social norms or gender stereotypes.

Overcoming unequal pay across both genders that are not explained by productivity characteristics requires a wide range of policies and sustained effort at various levels. In practice, achieving equal pay between men and women needs to be prompted through strong policies aimed at combating discriminatory practices and gender-based stereotypes about the value of women’s work, effective policies on maternity and paternity as well as parental leave, and advocacy for better sharing of family responsibilities. Finally, national legislation (i.e., "Equal Pay Act") must provide for the right to equal remuneration for work of equal value in line with the Equal Remuneration Convention, 1951 (No. 100) and effective judicial access to claim this right. Equal pay at the enterprise level also requires job evaluation methods free from gender bias. The legislation should require workers to pay

males and females within the same establishment for equal work at jobs equally. This means that workers should be rewarded correspondingly to their level of productivity and not in relation to ascriptive characteristics like gender (i.e., the principle of meritocracy). Furthermore, it should mandate all workers to report salary data to a third party entity separate from the government. Well-designed labor market policies and institutions will truly be effective in reducing inequality that arises in the Korean labor market.

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Appendix

〈Appendix Table 1〉 Probit Model of Labor Force Participation

Variables	Male	Female
AGE (Workers age; years)	0.359(0.064)***	0.255 (0.105)***
AGESQ (The square of *AGE*/100)	-0.396(0.064)***	-0.286 (0.110)***
MARRIED (Married)	0.021(0.341)	-0.608 (0.293)**
CAPITAL (Living in the capital area)	0.022(0.114)	0.118 (0.174)
Mother's Educational Attainment		
HSDROP (Less than high school graduates or high school diploma)	-0.010(0.127)	-0.109 (0.195)
COLLEGE (2-year college degree or above)	0.274(0.224)	0.068 (0.229)
Constant	-5.662(1.503)***	-3.564 (2.425)
Sample Size (Observations)	3,040	468

abstract

박사학위 소지자의 성별 임금격차 분해에 관한 연구

박 기 홍*

본 연구는 박사학위 소지자들을 대상으로 성별 임금격차와 그 원인에 대해 분석하였다. 국내 박사인력을 대상으로 하는 표본조사인 박사인력활동조사를 이용하여 박사학위 소지자들의 성별 임금격차 수준을 우선 식별하고, 임금격차에 대한 정확한 실태 파악을 위해 Oaxaca류의 임금격차 분해 모형을 이용하여 성별 임금격차를 두 집단의 인적특성 차이에 기인하는 임금차이와 임금방정식의 추정계수 차이로 인해 발생하는 임금차별로 분해하였다. 분석 결과 임금격차 중 임금분해 모형으로 설명이 불가능한 임금방정식의 구조적 차이로 인한 임금차별의 비중이 약 38~43% 수준으로 나타났으며, 이는 박사학위 소지자들의 성별 임금격차에도 노동시장에서의 차별에 관한 문제의 중요성이 크다는 것을 암시한다.

주제어: 차별, 박사학위 소지자, 젠더, 임금격차

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