The Interindustry Gender Wage Gap: Evidence from the Financial and Insurance Industry

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Abstract

This study examines the interindustry gender wage gap in Taiwan with a focus on the Financial and Insurance Industry, using individual level data from the 1978–2008 Manpower Utilization Survey. We study this issue from three perspectives: first, by decomposing, examining, and breaking down the overall gender wage gap, we find that 2–14% of the overall gender wage gap during this period can be attributed to workers' industry affiliation. Second, through the analysis of the gender wage gap across industries in Taiwan, we notice that the Financial and Insurance Industry is the most financially advantageous industry for women during the past decade. The wage level for women in the Financial and Insurance Industry was only 3%–16% below that of men. We conduct an in-depth analysis in the Financial and Insurance industry with a focus on the comparison of the gender wage gap for the insurance workers and non-insurance worker. The wage regression results indicate that there is more significant wage difference between insurance worker and non-insurance workers for males than that for females. The Oaxaca-Blinder wage decomposition suggests that the explained proportion of the gender wage gap tends to become smaller in the later years compared to that in the earlier years. Specifically, the explained proportions of the gender wage gap are all smaller than 50% in the years from 2006 to 2008.

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1 Introduction

The role of industry in affecting wage gaps is a topic worthy of more investigation. Ever since the seminal work by Becker (1957), studies on the gender wage gap have focused on identifying the sources of the gap, in order to learn more about the role of sex discrimination in the labor market. It was not until the 1990s that studies on interindustry differences in gender wage gaps were first addressed. By examining United States' data in 1988, Fields and Wolff (1995) (hereafter FW) found that "the combined industry effects explain about one-third of the overall gender wage gap." A recent study on European countries by Gannon et al. (2007) further indicated that the "combined industry effects explain 29 per cent of the gender wage gap in Ireland" while the "industry effects on the gender wage gap fluctuate sharply across European countries." Both studies highlight the important role played by industry in describing the phenomenon of gender wage gaps in Western countries.

The role that industry plays in affecting gender wage gaps should be even more significant for export-oriented countries, because their industrial structure is more responsive to changes in the composition of export products. Since Taiwan is a well-known export-oriented economy, an analysis based on Taiwan's data can serve as a representative case study. Taiwan's industry and export mixes have shifted toward more highly-skilled, technology-intensive products, while lower-skilled, labor-intensive industries have moved abroad. As a result, we expect to observe changes in the interindustry wage differentials for both genders. These changes may lead to a variation in the pattern of gender wage gaps by industry. The purpose of this study is to examine the role of industry in the gender wage gap in Taiwan with a focus on the Financial and Insurance Industry.

This study expands the current literature on Taiwan's gender wage gap by examining the issue through various approaches. First, we study the topic through a wage decomposition analysis. Second, we look into the topic through an analysis on the gender wage gap across industries to signify the role of industry in the gender wage gap of Taiwan. Third, we conduct a detailed wage decomposition analysis in the Financial and Insurance Industry with a focus on the comparison of the gender wage gap for the insurance workers and non-insurance workers.

The remainder of this paper is organized as follows. The next section briefly discusses the literature and the definition of industry classification. Section 3 describes the 1978–2008 Manpower Utilization Survey (MUS) datasets and the econometric methods. Section 4 presents and discusses the empirical results. The final section concludes the study.

2 Literature Review and Industrial Classification

Zveglich et al. (1997) found a persistent gender wage gap in Taiwan from 1978 to 1992, with women earned 65% of what men earned. This ratio exhibits an increasing trend from 1992 onward, reaching a level of about 75% in 2001 and remaining at this level till now. Many studies have empirically examined the continuing existence of the gender wage gaps in Taiwan. The focus of these studies has mainly been on identifying the role of sex discrimination in the labor market. Therefore, most of the existing literature on gender wage gaps in Taiwan has applied the Oaxaca (1973) and Blinder (1973) (hereafter OB) decomposition framework, which uses the unexplained portion of the wage gap as a proxy for sex discrimination.

Gannicott (1986), using the 1982 MUS data, found that the unexplained portion of the female-male wage gap accounts for about 60% of the gap. Liu and Liu (1987) showed significant gender wage gap differentials across occupations in Taiwan's labor market. Kao et al. (1994) incorporated the Polachek's expected human capital approach into their analysis based on 1989 data and found that more than 80% of the gender wage gap could be explained by the difference in the expected investment in human capital between males and females. Tan (1998) modified the OB decomposition model by taking into consideration the problem of sample selection bias due to the public-private sector choice. Tseng (2001)'s study found that the unexplained portion of the gender wage gap increased from 55% to 67%, and then to 74%, based on 1982, 1992, and 2000 data.

Differences among the gender wage gaps across industries in Taiwan suggest that more emphasis should be placed on the role of industry in explaining Taiwan's gender wage gaps. As shown in Figure 1, there is an apparent variation in gender wage gaps across industries. For instance, the female-male wage ratio in the agriculture, forestry & fisheries industry (hereafter, the Agriculture Industry) is consistently lower than the overall female-male wage ratio in Taiwan, while this ratio for the Construction Industry is always higher than the overall ratio. Moreover, the variation in the female-male wage ratio in the Mining Industry over time is more volatile compared to that in the other industries. Indeed, Zveglich et al. (1997) noted that ” “Education and experience account for most of the explained gap before 1989, while occupation and industry characteristics dominate thereafter.” These findings, coupled with those shown in Figure 1, suggest that the role of industry in explaining the gender wage gap in Taiwan should be emphasized.

FW have developed a unique econometric method to study the interindustry variation in gender wage gaps. They extended the OB decomposition approach to allow for industry dummies, which enable them to identify the role of industry in gender wage gaps more clearly. FW applied this method to the U.S. labor market, based on the 1988 Current Population Survey (CPS) data. Their findings indicate, “Of the overall gender wage gap, 12–22% can be explained by differences between the patterns of the interindustry wage differentials of men and women and 15–19% by differences in the distribution of male and female workers across industries.”

Inherent within FW’s framework are industry identification insufficiencies and standard error problems. In order to resolve these problems implied in FW’s framework, Horrace and Oaxaca (2001) (hereafter HO) proposed several alterative indicators to measure gender wage gaps across industries. They also conducted an empirical analysis using U.S. 1998 CPS data to illustrate the advantages and disadvantages of each measurement. Other academics have used similar approaches to FW and HO to study the interplay between gender wage gaps and the interindustry wage differentials of European countries (e.g., Rycx and Tojerow, 2002; Gannon et al., 2007).

The level of industrial classification is another issue addressed in the literature. The study that focuses on analyzing interindustry wage differentials and gender wage gaps commonly uses a one-digit industrial classification. For instance, studies based on U.S. data by Horrace (2005) and HO, and Ural et al.’s (2009) study on South Korean data are mainly conducted at the one-digit level. Studies including higher-digit level industrial classification (mostly at the two-digit or three-digit level) in their analysis such as FW’s study on U.S. data and the study on Belgium by Rycx and Tojerow (2002), each investigated the gender wage gap across industries at the one-digit level as well. Although the one-digit industrial classification is commonly used in the literature, FW noted that a finer industry dis-aggregation, such as the three-digit industrial classification used in their study, yields a much higher industrial effect than that found in most previous research.

This study uses the one-digit classification to define the industry dummy variables. The one-digit classification is compatible with the industry variable definition commonly used in the empirical literature on gender wage gaps in Taiwan (Gannicott, 1986 and Kao et al., 1994). This way of classifying industries allows us to compare our earnings equations' estimation results with those found in the literature. The difference between Taiwan's Standard Industrial Classification (TSIC) and International Standard Industrial Classification (ISIC) is relatively minor at the one-digit level, as shown in the Appendix of Chuang and Lin (2011). Therefore, a one-digit classification will make our cross country comparison more credible. The details of the contents of the one-digit industrial classification of TSIC can be found in the Appendix of Chuang and Lin (2011). During the 1978–2008 sample period, TSIC underwent five revisions. The one-digit classification changed from 10 to 19 categories. This study applies the 10-category classification in order to maintain a consistent definition of the industry dummy variable.

In summary, the line of literature that focuses on the gender wage gap across industries is particularly useful in measuring the contribution of industry effects to the overall gender wage gap. Since few works apply these recently developed techniques to study the gender wage gap in Taiwan, this study attempts to fill this gap. In addition, this study will conduct a further analysis on the Financial and Insurance Industry (hereafter the Finance Industry) by comparing the gender wage gap for the insurance workers and non-insurance workers.

3 Data and Methods

3.1 Data Description

Our data are taken from the Directorate-General of Budget, Accounting and Statistics of the Executive Yuan in Taiwan. The MUS survey has been conducted annually since 1978 with the purpose of understanding manpower utilization in the Taiwan Area.[1] The survey's sample is drawn from civilians aged 15 and older in the sample households. There are about 18,000 randomly drawn sample households in each year's survey. The data used in this study

[1] For related studies using MUS datasets, please refer to Zveglich et al. (1997), Lin (2010), and Lin and Yun (2010).

cover 1978 to 2008. As we focus on the gender wage gap, the sample used in our analysis is restricted to paid employees in the private sector aged between 15 and 65. The key variable in this study, the wage rate, is defined based on the data for monthly wage income. Therefore, our analysis excludes samples that do not have information on the monthly wage income.[2]

The MUS datasets contain information regarding the wages paid to both females and males, as well as information about control variables that are commonly included in a wage function, such as human capital variables, family background variables, and job characteristic variables. Table 1 presents the detailed definitions of the variables. It is noted that the MUS datasets used in this study are drawn from an individual-level survey. As a result, the Mincerian wage equation is more suitable for the current study. Additionally, most of the existing literature using the MUS datasets applies a Mincerian type of wage equation. Our estimation results can be compared with most of the existing literature on the same grounds.

3.2 Estimating Mincerian Wage Regression

The theory underlying this study's wage equation specification is based on Mincer's human-capital earnings function (Mincer and Polachek, 1974), which is commonly applied in studies based on individual-level data.[3] We estimate the Mincerian wage equation for males and females in each year as follows:[4]

$$y_i^\ell = \alpha^\ell + x_i^\ell \theta^\ell + \sum_{j=1}^{J} \beta_j^\ell d_{ij}^\ell + \sum_{k=1}^{K} \pi_k^\ell q_{ik}^\ell + \varepsilon_i^\ell,\ \ \ell \in \{f, m\};\ \ i = 1, ..., N;\ \ N \in \{F, M\}, \qquad (1)$$

where (1) represents the log-wage regressions for F females and M males, respectively. Superscript ℓ denotes the gender indicator, where f stands for female and m stands for male;

[2] The "wage rate" used in this study does not include other labor compensation. It includes only wages earned by a worker on a regular basis (i.e., the regular income). This definition is in line with the wage rate commonly used in the literature on the gender wage gap. In addition, the wage income, on average, accounts for more than 80% of the total compensation for employed workers in Taiwan. The ratio is 86% in 1978 and drops to 80% in 2008.

[3] For detailed discussion on the Mincerian wage regression and related studies, please refer to Chuang and Lin (2011).

[4] We should keep in mind that the potential problems in the specification of the Mincerian wage regression include the possibility of simultaneity that the choice of industry and/or occupation is endogenous and that the relationship between experience and earnings may be mutually causal. Given that the average tenure of our samples ranges from 4.2 to 6.6 years, the industry and occupational choice may be considered to be pre-determined in this study. On the other hand, if we exclude industry dummy variables, then the wage regression equations may suffer from an omitted variable bias.

y_i = the logarithm of the hourly wage, which is the monthly earnings divided by (weekly working hours $\times$ 4.33 weeks); continuous regressors x_i include education, potential experience, squared potential experience, job tenure, squared job tenure; d_{ij} = a dummy variable that equals one if the ith worker is employed in the jth industry, and equals zero otherwise;[5] q_{ik} = a collection of other sets of dummy variables, such as a binary variable for marital status, three binary variables for living area, and six dummy variables for occupations, etc. Without loss of generality, the first category is set as the left-out reference group both in the J and K classifications, i.e., $d_{i1} = q_{i1} = 0$. α, θ, β, and π are parameters to be estimated. Lastly, ε_i is the disturbance term.

3.3 Assessing Interindustry Gender Wage Gaps

Given the estimated Mincerian wage regression in (1), we can compute the log-wage for a representative male and a representative female worker in industry j by averaging the fitted values in (1) for all persons in industry j as follows:

$$\hat{y}_j^\ell = \hat{\alpha}^\ell + \bar{x}_j^\ell \hat{\theta}^\ell + \hat{\beta}_j^\ell + \sum_{k=1}^{K} \hat{\pi}_k^\ell \bar{q}_{jk}^\ell, \;\; \ell \in \{f, m\}; \;\; j = 1, ..., J, \tag{2}$$

where $\bar{x}_j^\ell$ and $\bar{q}_{jk}^\ell$ are the mean characteristics of a representative worker in industry j. In addition, a "hat" in (2) denotes the estimated counterpart of the true parameter throughout this paper.

Following OB strategy, we decompose the gender wage gap in industry j into unexplained and explained components as follows:[6]

$$\begin{aligned} \hat{y}_j^f - \hat{y}_j^m = (\hat{\alpha}^f - \hat{\alpha}^m) + (\hat{\beta}_j^f - \hat{\beta}_j^m) + \bar{x}_j^f(\hat{\theta}^f - \hat{\theta}^m) + \sum_{k=1}^{K} (\hat{\pi}_k^f - \hat{\pi}_k^m)\bar{q}_{jk}^f \\ + \sum_{k=1}^{K} \hat{\pi}_k^m (\bar{q}_{jk}^f - \bar{q}_{jk}^m) + (\bar{x}_j^f - \bar{x}_j^m)\hat{\theta}^m, \end{aligned} \tag{3}$$

[5] We have combined the Mining and Electricity, Gas and Water industries into one category due to the small sample issue that led to the multicollinearity problem in the estimation for some years when these two types of industry are separated. As shown in the Appendix of Chuang and Lin (2011), a major type of Mining industry is Energy Mining which is closely related to the Electricity, Gas and Water industries. To some extent, this may justify our combining these two groups of industries in order to gain more observations.

[6] Note that we follow the line of HO to express the gender wage gap in industry j by subtracting the predicted wage of the male from that of the female. However, Zveglich et al. (1997) described the gender wage gap by subtracting the predicted wage of the female from that of the male.

where the first four terms on the right-hand side of (3) are the unexplained components, while the last two terms correspond to the explained wage gap in industry (3). It is well known that the OB decomposition suffers from the so-called index problem, i.e., the decomposition is not invariant to the selection of the unobserved non-discriminatory wage structure (Neumark, 1988; Ferber and Green, 1982). In this paper the index problem is referred to as the first identification problem (**IP1**), while the problem regarding the choice of the left-out reference group (Oaxaca and Ransom, 1999) is referred to as the second identification problem (**IP2**).

FW defined the industry gender wage gap for industry j as:

$$\hat{g}_j = (\hat{\alpha}^f - \hat{\alpha}^m) + (\hat{\beta}_j^f - \hat{\beta}_j^m). \tag{4}$$

Instead of viewing the difference between the coefficients of the jth industry for males and females, FW added an extra term, $\hat{\alpha}^f - \hat{\alpha}^m$, to capture the effect of choosing the reference group. However, $\hat{g}_j$ is not invariant to the choice of the left-out reference group according to the discussion in Oaxaca and Ransom (1999) even though it is able to get rid of **IP1**.

HO then proposed the four alternatives (i.e., $\hat{\phi}_j$, $\hat{\delta}_j$, $\hat{\gamma}_j$, and $\hat{\rho}_j$) to overcome **IP2.**[7] It turns out that $\hat{\delta}_j$ and $\hat{\phi}_j$ are free from **IP2,** but they still suffer from **IP1**.[8] This is because we have to arbitrarily pick the male wage as the unknown non-discriminatory wage structure in the decomposition of the overall gender wage gap in equation (3). On the other hand, the ranking-based measures $\hat{\rho}_j$ and $\hat{\gamma}_j$ need to simulate the critical values in order to conduct a statistical inference (Horrace, 2005).

We are thus motivated to adopt the measure recently developed by Lin (2007b, 2010), which resolves both **IP1** and **IP2** and provides a handy standard error for the significance test.[9] The idea of the new measure is that the normalized regression approach for the detailed Oaxaca decomposition offers a simple resolution to **IP2** (Yun, 2005). It is natural to extend the normalized regression approach to the gender wage gap by industry.

Following the normalized regression approach, the overall gender wage differential in

[7] The first three measures can be found on page 613 of HO, while the measure $\hat{\rho}_j$ that can be regarded as an extension of $\hat{\gamma}_j$ is defined in Table 4 on page 617.

[8] HO treated the regressors as non-stochastic and derived the corresponding standard errors for the measures $\hat{\phi}_j$ and $\hat{\delta}_j$. Lin (2007a) calculated the correct standard errors under the stochastic regressors assumption.

[9] The new measure has been applied to explore the gender wage gap by college major in Lin (2010). Lin and Yun (2010) also discussed this new measure in greater detail.

industry j can be decomposed as follows:

$$\bar{y}_j^f - \bar{y}_j^m = (\hat{\alpha}^{f+} - \hat{\alpha}^{m+}) + (\hat{\beta}_j^{f+} - \hat{\beta}_j^{m+}) + \sum_{k=1}^{K} (\hat{\pi}_k^{f+} - \hat{\pi}_k^{m+}) \bar{q}_{jk}^f + \bar{x}_j^f (\hat{\theta}^f - \hat{\theta}^m) \qquad (5)$$
$$+ \sum_{k=1}^{K} \hat{\pi}_k^{m+} (\bar{q}_{jk}^f - \bar{q}_{jk}^m) + (\bar{x}_j^f - \bar{x}_j^m) \hat{\theta}^m,$$

where $\hat{\alpha}^+ = \hat{\alpha} + \widehat{\bar{\beta}} + \widehat{\bar{\pi}}$, $\hat{\beta}_j^+ = \hat{\beta}_j - \widehat{\bar{\beta}}$, $\hat{\pi}_k^+ = \hat{\pi}_k - \widehat{\bar{\pi}}$, $\bar{\beta} = \sum_{j=1}^{J} \beta_j / J$ and $\bar{\pi} = \sum_{k=1}^{K} \pi_k / K$.[10] Based on the decomposition equation in (5), Lin (2007b) proposed an alternative industrial gender wage gap measure, which is in the spirit of the measure of FW ($\hat{g}_j$) in that it uses coefficients of the normalized equations. The new measure $\hat{\lambda}_j$ is defined as follows:

$$\hat{\lambda}_j = (\hat{\alpha}^f - \hat{\alpha}^m) + (\widehat{\bar{\pi}}^f - \widehat{\bar{\pi}}^m) + (\hat{\beta}_j^f - \hat{\beta}_j^m), \qquad (6)$$

where $\hat{\lambda}_j$ is identified since it is free from the choice of the left-out reference group of any dummy variables (e.g., Oaxaca and Ransom, 1999) and the choice of the unobservable non-discriminatory wage structure (e.g., Neumark, 1988; Oaxaca and Ransom, 1994). Compared to the ranking-based measures, $\hat{\lambda}_j$ is ready for a statistical inference since the standard errors are easy to compute after a simple transformation.[11]

Note that the rankings of the measures are divided into two groups. One is for the measures ($\hat{\delta}_j$, $\hat{g}_j$, $\hat{\lambda}_j$, $\hat{\gamma}_j$) and the other is for ($\hat{\phi}_j$, $\hat{\rho}_j$). The index in each group shares the same ranking, even though the rankings are not the same for the two groups. In addition, the higher the ranking is (i.e., the smaller the ranking number), the smaller the gender wage gap will be for a specific industry. In what follows, we adopt the measures introduced by FW and HO as well as by Lin (2007b, 2010) to estimate the interindustry gender wage gaps.

4 Empirical Results

4.1 Wage Decomposition and the Role of Industry

Our general findings for the Mincerian wage equations are consistent with findings in the literature. As specified in (1), these regressions are separately estimated for females and

[10] Chuang and Lin (2011) detailed the normalized regression approach.

[11] Chuang and Lin (2011) described the computation of the variance covariance matrix for $\hat{\lambda}_j$.

males in each year. The results show that the (log) wages are concave in job tenure. The marriage premium is positive for males in most years, but is negative for females in several of the years.

Our variables of the greatest interest are the industry variables. With the Mining Industry as the reference group, there are seven industry dummy variables. Most of the coefficients of the industry dummies are significant, even though the earnings function controls for schooling, experience, tenure, marital status, occupation, and region variables. The industry variables are jointly significant for males, females, and the total samples for each year.

We apply the OB decomposition techniques to assess the contribution of the industry dummies to explaining the gender wage gap. We decompose the gender wage gap based on the regression with and without the industry dummy. Table 2 reports the decomposition results for some selected years. We conduct the decomposition calculation according to the male-based, female-based, and average-based approaches. As claimed by Ferber and Green (1982), the decomposition results may differ substantially depending on the calculation basis of the non-discriminatory wage structure (a wage structure that is unaffected by gender discrimination). Our results indicate the female-based calculation tends to yield a higher percentage of the explained proportion. Using the OB techniques, we find that the role of industry is significant.

Industry's significance in explaining gender wage gaps is readily apparent when we note the explained proportion increases when the industry dummy is included. This increase holds for each year regardless of whether we use estimates from male-based, female-based, or the average-based approaches for our calculation. For the case of the average-based calculation, the explained proportion varies from 27% to 49% based on the regression with the industry dummy. However, without the industry dummy, the explained proportion is smaller, ranging from 17% to 41%. The inclusion of the industry dummy increases the explained proportion of the gender wage gap by 2% to 14%, revealing the importance of the industry variables. The significant F-statistics for testing the joint contribution of adding the industry dummies provide further evidence that industry plays an influential role in contributing and explaining the gender wage gap.

4.2 Interindustry Gender Wage Gaps

We calculate the various measures for the interindustry gender wage gap described in Section 3.3, and their corresponding standard errors, in order to examine the gender wage gap across industries. Table 3 reports the estimated results for some selected years.[12] As expected, most of the industry gender wage gaps are negative, because males generally earn more than females. This holds even after controlling for productivity-related characteristics of workers. Even though most measures are negative, some positive signs are found for the measures $\hat{g}_j$ and $\hat{\lambda}_j$.

The magnitude of the wage gap, based on the statistically significant estimates, indicates that there are notable variations in the gender wage gaps across industries. For example, in 2008 the Finance Industry shows the smallest gender wage gap (-0.0559 based on $\hat{\delta}_j$ and -0.0396 based on $\hat{\phi}_j$) while the Service Industry has the largest gender wage gap (-0.1945 based on $\hat{\delta}_j$ and -0.1725 based on $\hat{\phi}_j$). These figures suggest that women in the Finance Industry earn 5.59% (based on $\hat{\delta}_j$ and 3.96% based on $\hat{\phi}_j$) less than men, and in the Service Industry women have a 19.45% (based on $\hat{\delta}_j$; 17.25% based on $\hat{\phi}_j$; and 13.16% based on $\hat{\lambda}_j$) lower wage than that of men. In 2008 there were smaller wage gaps between male and female workers in the Finance Industry, while the gender wage gaps were larger in the Service Industry. The magnitude of the gender wage gap is generally larger for the measures $\hat{\delta}_j$ and $\hat{\phi}_j$ compared to that of the measures $\hat{g}_j$ and $\hat{\lambda}_j$.

According to the industry ranking discussion in Section 3.3, a higher ranking (smaller ranking number) implies a smaller gender wage gap for a specific industry. There are two groups of industry ranking for these measures: the $\hat{\delta}$-group and the the $\hat{\phi}$-group measures. The Mining Industry continued to occupy the lowest ranking (8^{th}) from 1978 to 1991, based on both groups of measures except for 1988. Females in the Mining Industry faced the largest gender wage gap compared to those in other industries during 1978-1991. Since 1991, the Mining Industry has not necessarily been the least advantageous industry to females, but it is still the most frequently observed lowest ranking industry during these years. The industry that ranks the highest (with the least gender wage gap) varies year by year for different measures during the years before 1997. For example, based on the $\hat{\delta}$-group measures, the

[12] Detailed results are available from the authors upon request.

most advantageous industry for women is the Agriculture Industry for 1978, but it changes to the Construction Industry for 1997. Based on the $\hat{\phi}$-group measures, the highest ranking industry is the Trading Industry in 1978 and the Finance Industry in 1997. The pattern of the industry ranking over time can be understood more clearly in Table 4. It reports the highest and lowest ranking industries, the corresponding estimated gender wage gaps, and the range of the highest and lowest ranking industries for selected years.[13]

Starting from 1982, the Finance Industry represents the highest ranking industry for each year except for the 1992–1995 years based on $\hat{\phi}_j$. Females in the Finance Industry have in fact experienced the smallest gender wage gaps compared to workers in other industries in most years. Although the $\hat{\delta}$-group measures pick the Construction Industry as the most advantageous industry for women in most years before 1997, these measures indicate that females in the Finance Industry have faced the smallest gender wage gap since 1998. In other words, both groups of measures suggest that the Finance Industry is the most advantageous industry for women during the past decade. The wage level for women in the Finance Industry is 3–16% below that for men.

As to the industry least advantageous to women, both groups of measures indicate that the Mining Industry was the lowest ranking industry for females before 1991 (the $\hat{\phi}$-group measures in 1988 was the only exception). Women in the Mining Industry earned a wage 35–93% below that for men. As noted earlier, there is less commonality in the lowest ranking industry from 1992 onwards. Based on our discussion, we may conclude that the Mining Industry is the least advantageous industry and that the Finance Industry is the most advantageous industry for females.[14]

[13] The ranking and the range for $\hat{\lambda}_j$ are exactly the same as those for $\hat{\delta}_j$. Table 4 therefore only reports the results for $\hat{\delta}_j$ and $\hat{\phi}_j$.

[14] We also examine how sensitive our results of the interindustry gender wage gaps are to the specification of the wage equation, using the 2008 data as an example. The results from our examination imply that various specifications lead to a similar conclusion. We conduct this examination by calculating all the measures using the estimates from the wage equation excluding the job characteristic variable – firm size. Our findings indicate that the sign and the significance level of $\hat{\delta}_j$ and $\hat{\phi}_j$ are very similar based on both specifications. The magnitudes of the interindustry gender wage gaps differ only slightly. The interindustry gender wage gap ranges from -0.0559 to -0.1945 under the original specification and it ranges from -0.0546 to -0.1920 under the specification without the job characteristic variable based on $\hat{\delta}_j$. The ranges are from -0.0396 to -0.2274 versus from -0.0426 to -0.2228 for the $\hat{\phi}_j$ measure. The highest and the lowest ranking industry are exactly the same under both specifications. The industry ranking in-between may differ. However, their difference in ranking is within one or two ranks. For example, the Service Industry ranks number 6 under the original specification and it ranks number 5 under the specification without the job characteristic variable

When we further examine the employment ratio in these two industries, we notice that over time, fewer women are employed in the Mining Industry and more women work in the Finance Industry. For the Mining Industry, the 1978–1991 average employment ratio is 0.27%, but the 1992–2008 average employment ratio declines to 0.11%. This ratio for the Finance Industry increases from 4.10% to 11.13% over the same periods. The transition of females from the least to the most advantageous industry over time may provide some explanation of the trend toward the narrowing of the gender wage gap from 1992 onwards. This may also justify the view that all the different measures consistently indicate that the Mining Industry is the lowest ranking industry before 1992 and that the Finance Industry is the highest ranking industry from 1998 on.

Table 4 also indicates that the range based on $\hat{\delta}_j$ is smaller than that based on $\hat{\phi}_j$ for most years. The range is smaller after 1999, suggesting that there is less variation in the interindustry gender wage gap during the most recent years. This finding is consistent with the trend towards a narrowing of the gender wage gap. The dispersion of the gender wage gap by industry becomes smaller, because the overall gender wage gap is shrinking.

A cross country comparison with the results from HO suggests that the range of the interindustry gender wage gap in Taiwan is larger than that in the U.S.[15] Our estimated ranges are also larger than those found in Belgium according to Rycx and Tojerow (2002). The implication of the industry ranking of the gender wage gap is quite different between the Taiwan and U.S. labor markets. The Finance Industry is more likely to rank the highest in Taiwan while it ranks the lowest based on $\hat{\delta}_j$ (and the second lowest based on $\hat{\phi}_j$) in the

based on the $\hat{\phi}_j$ measure. In sum, the results derived from both specifications lead to a similar conclusion.

[15] It would be more interesting to compare our findings to those of other Asian countries. However, to our knowledge, there is not much empirical work using a similar estimation approach to measure interindustry gender wage gaps for Asian countries in the literature. Most empirical studies treat the industry dummies as a set of explanatory variables of the wage regression, e.g., the case of Thailand in Fang and Sakellariou (2011). Including the industry variables does not help to explain the gender wage gaps in Thailand, while it does increase the explained proportion of the OB decomposition in our study. Some studies simply group the female and male samples by industry and then perform separate decomposition analyses, e.g., the gender wage gap of Bangladesh in Kapsos (2009), where the explained proportion in the financial intermediation industry can be up to 60%. Ural et al.'s (2009) study based on South Korean data is one among the few that applied a similar approach. They used four industrial classifications: knowledge-based manufacturing, other manufacturing, knowledge-based service, and other service. Their findings suggest that the non-discriminatory percentage is the highest in the knowledge-based service sector. This implies that the discriminatory gender wage gap is the lowest in this sector. The Finance Industry, the industry more likely to have the smallest gender wage gap in Taiwan, is classified as being in the knowledge-based service sector in Ural et al. (2009).

U.S. labor market.[16] The Agriculture Industry is found to possess the smallest gender wage gap in HO, whereas it is found to have a larger gender wage gap (ranked 7^{th} in 1998 and ranked 7^{th} in 2008 based on $\hat{\phi}_j$) in our study. It is worthwhile studying further what the driving forces are that result in the opposite performances of the interindustry gender wage gap between the Taiwan and U.S. labor markets.

4.3 The Gender Wage Gap in the Finance Industry

As the Finance Industry is the most advantageous industry for women during the recent years in our sample period, this study conduct a further analysis on the gender wage gap in the Finance Industry based on the data from 2000 to 2008. The Micerian wage regression is estimated for males and females in the Finance Industry respectively for each year. The specification of the Micerian wage equation is similar to that in equation (1) except for the industry and occupation variables. We only include one industry dummy variable, *insurance*, to capture the difference between the insurance and non-insurance workers in the Finance Industry.[17] The occupation variables are re-categorized into one dummy variable, *skill*, which is set to 1 for the first four types of occupations reported in Table 1, and 0 for the other occupations.

The estimation results of the Micerian wage equation for the year 2008 is reported in Table 5. The human capital variables have shown very significant influence on the wages for both male and female worker in the Finance Industry. Among all the human capital variables, the schooling variable has the strongest impact on the wages. Both the experience and the tenure variables show a nonlinear effect on the wages with a concave shape similar to the result for total samples. As to the role the job characteristics, firm size play a more significant role than the firm's location. The occupation makes a difference on wages for both male and female workers in the Finance Industry. The white collar workers (or more skilled workers) tend to have higher wages than the others, as expected. Except for the industry

[16] The results in HO are based on the 1998 CPS data for one-digit industries and the results in Rycx and Tojerow (2002) are based on the 1995 ESES for two-digit industries. Again, we should be very cautious when interpreting these comparisons, because the definitions of the industry classification may differ across countries.

[17] The Finance industry includes the Financial Intermediation, Insurance, Securities, Futures and Other Financing, Real Estate Development Activities and Real Estate Operation and Related Activities based on the two-digit industrial classification of TSIC 2011 version.

dummy variable, the general implication of these estimation results hold true for the rest of the years from 2000 to 2007.

This study pays a special attention on the comparison of the insurance workers and non-insurance workers in the Finance Industry since the regulation in the Insurance sector is quite different from that for the other sectors in the Finance Industry. In addition, there are not many literatures on the gender issue of wage for insurance worker. Worrall, Appel and Butler (1987) and Selén and Ståhlberg (2011) are among the few. Table 6 reports the estimation result of the insurance dummy variable for the years from 2000 to 2008. It is noted that there is more significant difference in the wages for the males between insurance industry and non-insurance industries than that for females. Starting from the year 2004, male workers in the insurance industry tend to have lower wages compared to the non-insurance male workers. For female workers the wage difference between the insurance and non-insurance industries is less significant.

We conduct the OB decomposition of the gender wage gap in the Finance Industry for the years from 2000 to 2008. Table 7 summarizes the decomposition results using female-based, male-based and the average-based calculation respectively. It is worthwhile to notice that the decomposition results differ substantially depending on the calculation basis of the non-discriminatory wage structure. As shown by the wage gap reported in Table 7, the gender wage gap is narrowing down over time in the Finance Industry. However, the explained proportion of the gender wage gap tends to become smaller in the later years compared to that in the earlier years. Especially for the most recent three years, the explained proportions of the gender wage gap are all smaller than 50%. In other words, more than half of the wage gap cannot be explained by the difference in the characteristics of the male and female workers. There are two possible explanations for this finding. One may attribute the results to more difference in the unobserved heterogeneity implied in the male and female workers that is not included in the current wage specification. On the other hand, it may be due to more discrimination against women in the Finance Industry.

A detailed decomposition is calculated in order to identify the contribution of the individual explanatory variable to explained part of the gender wage gap. Table 8 reports the result of the *insurance* variable for the years from 2000 to 2008. It is noted that the contribution of the *insurance* variable ranges from the lowest of -0.93% to the highest of 17.17%. Compared to the other explanatory variable, the average contribution of the *insurance* variable is in the median range. In other words, being an insurance worker can explain a certain part of the gender wage gap in the Finance Industry. However, its contribution is neither the major one nor the minor one.

5 Conclusion

This study applies various approaches, including wage decomposition, interindustry gender wage gap, and detailed decomposition, to examine the role of industry in explaining the gender wage gap in Taiwan based on 1978–2008 MUS data with a focus on the Finance Industry. We first apply the OB wage decomposition approach to measure the contribution of the industry dummy variables. We find that the inclusion of the industry dummy increases the explained portion of the gender wage gap over our sample period by 2% to 14%.

We also apply various measures developed in the recent literature to estimate the interindustry gender wage gap. Our estimation results suggest that women in the Finance Industry have a 4–6% lower wage than men, and in the Agriculture Industry women have a 15–23% lower wage than men for 2008. The pattern of industry ranking for the gender wage gap over time suggests that the Mining Industry is more likely to be the most disadvantageous industry to women. However, the Finance Industry tends to be the most advantageous industry for female workers over time. As a result, we conduct a further analysis on the Finance Industry with a focus on the difference between insurance workers and non-insurance workers. The wage regression results indicate that there is more significant wage difference between insurance workers and non-insurance workers for males than that for females. The OB decomposition suggests that the explained proportion of the gender wage gap tends to become smaller in the later years compared to that in the earlier years. Especially for the most recent three years of our sample period, the explained proportions of the gender wage gap are all smaller than 50%.

To sum up, this study provides a benchmark platform for future research. Many extensions can be developed from this study. For instance, further analysis on the cause and effect of the wage differentials between insurance workers and non-insurance workers in Taiwan's labor market would be an interesting extension. It would also be worthwhile to conduct a thorough study on the interindustry wage differentials for a sub-sample of college graduates since there are quite a few college graduates employed in the Finance Industry.

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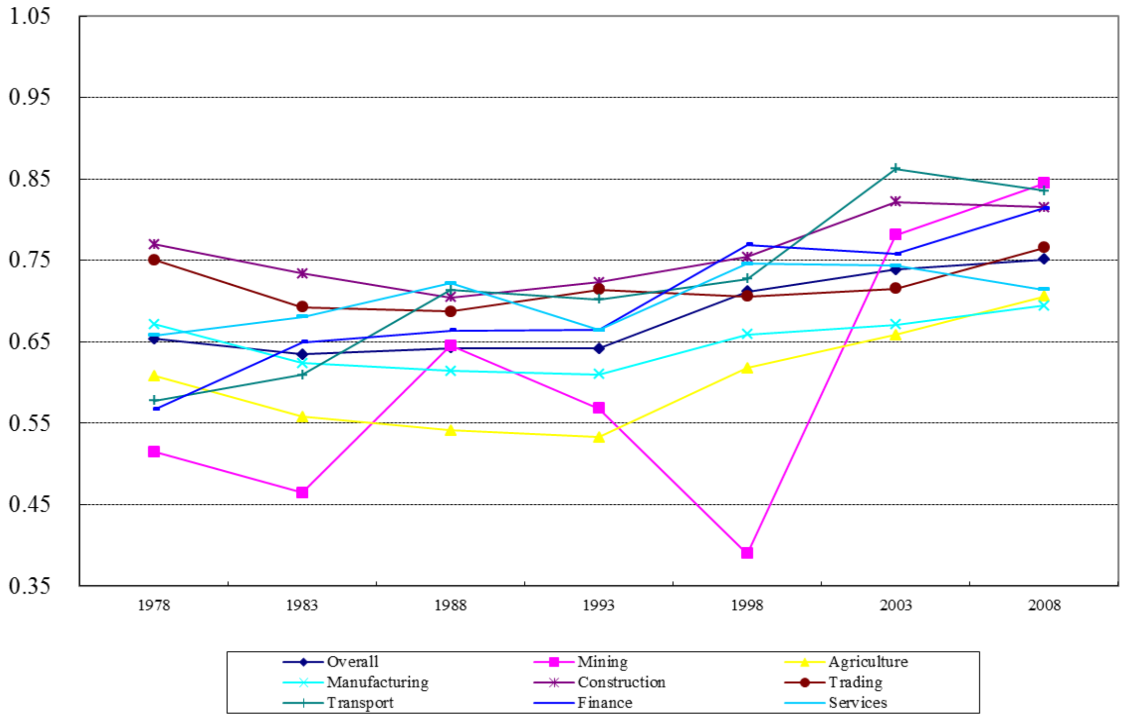

Figure 1: Female-Male Wage Ratio by Industry

Table 1: Variable Definitions

Variables	Definitions
Log(Hourly Wage)	log[monthly income/(weekly working hours*4.33 weeks)]
Schooling	illiterate: 0; elementary school: 6; middle school: 9; high school: 12; college: 14; undergraduate: 16; master: 18; and PhD: 22
Experience	
Job Tenure	experience at the current job
Job Tenure^2	squared job tenure
Potential Exper.	age - years of schooling - 6
Potential Exper.^{2}	squared potential experience
Industry	Mining (reference group), Manufacturing, Transportation, Finance, Services, Construction, Trading and Agriculture
Occupation	Legislators, Senior Officials and Managers; Professionals, Technicians and Associate Professionals; Clerical Support Workers, Service and Sales Workers; Craft and Related Trades Workers; Plant and Machine Operators and Assemblers; Elementary Laborers; Skilled Agricultural, Forestry and Fishery Workers are set as the reference group
Marital Status	1: married; 0: otherwise
Region	
North	1: Taipei, Keelung, Hsinshu Cities; and Taipei, Taoyuan, Hsinchu Counties
Central	1: Taichung City; and Miaoli, Taichung, Changhua, Nantou, Yunlin Counties
South	1: Chiayi, Tainan, Kaohsiung Cities; and Chiayi, Tainan, Kaohsiung, Pingtung, Penghu Counties
East	0: Taitung, Hualien Counties
Metropolitan Area	1: Keelung, Hsinchu, Taichung, Chiayi, Tainan, Taipei, Kaohsiung Cities; 0: otherwise
Firm Size	1: big firms with number of employees greater than 100; 0: otherwise
Majors	two dummy variables, one for literature, law, business & management, and education; the other for science, engineering, and medicine; with agriculture, military, and police as the reference group

Notes: [a] Mining denotes Mining, Quarrying, Electricity, Gas Supply and Water Supply; Transportation denotes Transportation, Storage and Communications; Finance denotes Financial, Insurance and Real Estate; Services denotes Social, Personal and Related Community Services; Trading denotes Wholesale and Retail Trade; and Agriculture denotes Agriculture, Forestry, Fishing, Animal Husbandry and Hunting based on the one-digit industrial classification of the TSIC 2011 revision.

[b] Log (Hourly Wage) denotes the dependent variable y_i in (1). The continuous independent variables x_i include Schooling and Experience. Here, d_i corresponds to the Industry dummy variables. The other discrete independent variables consist of dummy variables for Occupation, Marital Status, Region, Metropolitan Area, Firm Size, and Majors.

Table 2: Decomposition Results With and Without the Industry Dummies

Year	WI	W/O	WI-W/O	WI	W/O	WI-W/O	WI	W/O	WI-W/O
	Female-Based			Male-Based			Average-Based		
1978	57.93%	49.63%	8.29%	40.81%	32.90%	7.91%	49.37%	41.26%	8.10%
1983	42.96%	36.55%	6.41%	32.34%	18.27%	14.07%	37.65%	27.41%	10.24%
1988	30.77%	26.61%	4.16%	24.58%	14.49%	10.09%	27.67%	20.55%	7.12%
1993	30.22%	26.87%	3.35%	25.79%	12.22%	13.57%	28.01%	19.55%	8.46%
1998	31.40%	27.91%	3.48%	25.87%	17.84%	8.03%	28.63%	22.88%	5.76%
2003	36.35%	34.16%	2.19%	21.59%	15.21%	6.38%	28.97%	24.68%	4.28%
2008	39.77%	36.95%	2.82%	28.53%	23.07%	5.46%	34.15%	30.01%	4.14%

Notes: The decomposition is computed based on the following equation:

$$\hat{y}^f - \hat{y}^m = (\bar{x}^f - \bar{x}^m)\beta^* + \left[\bar{x}^f\left(\hat{\beta}^f - \beta^*\right) + \bar{x}^m\left(\beta^* - \hat{\beta}^m\right)\right]$$

where the first term is interpreted as the “explained” component of the gender wage gap and the second term is the “unexplained” component. Here, β^* denotes the unknown non-discriminatory wage structure. The Female-Based, Male-Based, and Average-Based panels correspond to decomposition results using female coefficients, male coefficients, and the average of male and female coefficients as the unknown non-discriminatory wage structures, respectively. WI and W/O denote "with" and "without" the industry dummies.

Table 3: Estimates of the Gender Wage Gap by Industry for Selected Years

Industries	$\bar{y}_j^f - \bar{y}_j^m$	$\hat{g}_j$	$\hat{\delta}_j$	$\hat{\lambda}_j$	$\hat{\gamma}_j$	Rank	$\hat{\phi}_j$	$\hat{\rho}_j$	Rank
1978									
Min.	-3091.01	-0.4427***	-0.4960***	-0.3560***	0.3849***	8	-0.5494***	0.3938***	8
Agr.	-1908.81	-0.0578	-0.1111	0.0289	0.0000	1	-0.3096***	0.1541***	7
Man.	-1759.08	-0.1218	-0.1751***	-0.0351	0.0640	3	-0.1687***	0.0131	2
Con.	-1342.96	-0.0917	-0.1450***	-0.0050	0.0339	2	-0.1820***	0.0264	3
Trd.	-1458.67	-0.1475	-0.2009***	-0.0609	0.0898	4	-0.1556***	0.0000	1
Tra.	-3154.49	-0.3147***	-0.3680***	-0.2280***	0.2569***	7	-0.2240***	0.0684	4
Fin.	-3510.16	-0.2063*	-0.2596***	-0.1196*	0.1485	6	-0.2394***	0.0838	6
Ser.	-1952.60	-0.1846*	-0.2380***	-0.0980*	0.1268	5	-0.2380***	0.0824**	5
1988									
Min.	-6435.70	-0.1500	-0.3183**	-0.1757	0.1498	8	-0.3642**	0.1970	8
Agr.	-6057.36	-0.0952	-0.2635	-0.1209	0.0950	5	-0.3616***	0.1943***	7
Man.	-6109.14	-0.0901	-0.2584***	-0.1158**	0.0899***	4	-0.3353***	0.1680***	6
Con.	-4865.40	0.0389	-0.1294***	0.0132	0.0000	1	-0.2461***	0.0789**	2
Trd.	-5341.90	-0.1157	-0.2840***	-0.1414***	-0.0391	6	-0.2813***	0.1140***	4
Tra.	-5661.20	-0.0417	-0.2100***	-0.0674	0.1155***	3	-0.2712***	0.1039	3
Fin.	-7197.80	-0.0002	-0.1685***	-0.0259	0.0415	2	-0.1672***	0.0000	1
Ser.	-4390.80	-0.1435	-0.3118***	-0.1692***	0.1433***	7	-0.3118***	0.1445***	5
1998									
Min.	-31655.30	-0.4038**	-0.6037***	-0.6707***	0.4765***	8	-0.5927***	0.4766***	8
Agr.	-10820.60	-0.2911***	-0.4910***	-0.5580***	0.3638***	7	-0.3202***	0.2041***	7
Man.	-11664.50	-0.0362	-0.2361***	-0.3031***	0.1089***	6	-0.3083***	0.1922***	6
Con.	-8377.40	0.0384	-0.1615***	-0.2285***	0.0343***	2	-0.2389***	0.1228***	4
Trd.	-10176.20	0.0206	-0.1793***	-0.2463***	0.0521***	3	-0.1859***	0.0698***	2
Tra.	-11279.60	-0.0007	-0.2006***	-0.2676***	0.0734***	5	-0.2425***	0.1294***	5
Fin.	-9925.80	0.0727	-0.1272***	-0.1942***	0.0000	1	-0.1161***	0.0000	1
Ser.	-9139.10	0.0080	-0.1919***	-0.2589***	0.0647***	4	-0.1919***	0.0758***	3
2008									
Min.	-5068.60	-0.0751	-0.1387**	-0.0757	0.0827***	3	-0.1655***	0.1259***	4
Agr.	-7609.00	-0.0858	-0.1494*	-0.0865	0.0935***	4	-0.2274***	0.1878***	8
Man.	-11415.60	-0.1147	-0.1783***	-0.1154***	0.1223***	6	-0.2209***	0.1813***	7
Con.	-6274.10	-0.0664	-0.1300***	-0.0671	0.0740***	2	-0.1657***	0.1261***	5
Trd.	-7684.20	-0.0948	-0.1583***	-0.0954**	0.1024***	5	-0.1257***	0.0861***	2
Tra.	-6824.30	-0.1179	-0.1815***	-0.1186**	0.1256***	7	-0.1356***	0.0960***	3
Fin.	-7632.10	0.0076	-0.0559***	0.0070	0.0000	1	-0.0396***	0.0000	1
Ser.	-11500.10	-0.1310	-0.1945***	-0.1316***	0.1386***	8	-0.1725***	0.1329***	6

Notes: [a] Min. denotes Mining; Man. denotes Manufacturing; Tra. denotes Transportation; Fin. denotes Finance;Con. denotes Construction; Trd. denotes Trading; Agr. denotes Agriculture; and Ser. denotes Services.

[b] *, **, and *** denote statistically significant at the 10%, 5%, and 1% significance levels, respectively.

Table 4: Summary Results of the Gender Wage Gap

Year	Estimators $\hat{\delta}_j$					Estimators $\hat{\phi}_j$				
	Highest		Lowest		Range	Highest		Lowest		Range
1978	-0.08	(Agr.)	-0.46	(Min.)	0.38	-0.12	(Trd.)	-0.55	(Min.)	0.44
1983	-0.11	(Con.)	-0.68	(Min.)	0.58	-0.15	(Fin.)	-0.80	(Min.)	0.65
1988	-0.16	(Con.)	-0.35	(Min.)	0.19	-0.14	(Fin.)	-0.35	(Agr.)	0.22
1993	-0.19	(Con.)	-0.48	(Agr.)	0.29	-0.18	(Trd.)	-0.45	(Min.)	0.27
1998	-0.16	(Fin.)	-0.63	(Min.)	0.48	-0.12	(Fin.)	-0.59	(Min.)	0.48
2003	-0.15	(Fin.)	-0.36	(Agr.)	0.21	-0.11	(Fin.)	-0.28	(Agr.)	0.17
2008	-0.06	(Fin.)	-0.19	(Ser.)	0.14	-0.04	(Fin.)	-0.23	(Agr.)	0.19

Note: Please see the endnote in Table 3 for the industry abbreviation.

Table 5 : Estimation Results of the Wage Equation in tha Finance Industry - Year 2008

	Male		Female	
Variable	Coef.	Std. Err.	Coef.	Std. Err.
Schooling	0.0529***	0.0060	0.0722***	0.0053
Job Tenure	0.0352***	0.0059	0.0377***	0.0050
Job Tenure^2	-0.0006***	0.0002	-0.0008***	0.0002
Potential Exper.	0.0144***	0.0039	0.0139***	0.0029
Potential Exper.^{2}	-0.0003***	0.0001	-0.0002***	0.0001
Insurance	-0.0584*	0.0356	-0.0133	0.0234
Skill worker	0.2968***	0.0273	0.1290***	0.0198
Marital Status	0.1142***	0.0286	0.0304	0.0203
North	0.0666	0.0705	0.1417***	0.0477
Central	-0.0391	0.0724	0.0614	0.0486
South	-0.0209	0.0723	-0.0287	0.0488
Metropolitan Area	0.0458**	0.0230	0.0023	0.0187
Firm Size	0.0744**	0.0304	0.1019***	0.0264
Major-1	0.0152	0.0355	-0.0172	0.0274
Major-2	-0.0587*	0.0323	-0.0166	0.0377

Note: [a] *, **, and *** denote statistically significant at the 10%, 5%, and 1% significance levels, respectively.

Table 6 : Estimation Results of the *Insurance* Variable for Years 2000 - 2008

	Male		Female	
Year	Coef.	Std. Err.	Coef.	Std. Err.
2000	-0.0765*	0.0469	-0.0672*	0.0414
2001	-0.0427	0.0466	0.0093	0.0434
2002	-0.0834*	0.0477	-0.0215	0.0381
2003	-0.0611	0.0480	-0.0400	0.0405
2004	-0.0828**	0.0353	-0.0511**	0.0258
2005	-0.0901*	0.0489	0.0187	0.0435
2006	-0.0875***	0.0325	-0.0549**	0.0287
2007	-0.0784**	0.0337	0.0371	0.0252
2008	-0.0534*	0.0356	-0.0133	0.0234

Note: [a] *, **, and *** denote statistically significant at the 10%, 5%, and 1% significance levels, respectively.

Table 7 : Decomposition of the Gender Wage Gap in the Finance Industry

Year	ln Wage Gap	Female-Based		Male-Based		Average-Based	
		Explained	%	Explained	%	Explained	%
2000	-0.2781	-0.1505	54.12%	-0.1440	51.78%	-0.1478	53.15%
2001	-0.2681	-0.0898	33.49%	-0.1312	48.94%	-0.1101	41.07%
2002	-0.2691	-0.1233	45.82%	-0.1004	37.31%	-0.1098	40.80%
2003	-0.2118	-0.1139	53.78%	-0.0590	27.86%	-0.0818	38.62%
2004	-0.2253	-0.0885	39.28%	-0.1157	51.35%	-0.1046	46.43%
2005	-0.1799	-0.1045	58.09%	-0.1140	63.37%	-0.1080	60.03%
2006	-0.1723	-0.0519	30.12%	-0.0730	42.37%	-0.0653	37.90%
2007	-0.1050	-0.0365	34.76%	-0.0328	31.24%	-0.0330	31.43%
2008	-0.1092	-0.0501	45.88%	-0.0309	28.30%	-0.0376	34.43%

Table 8: Contribution of the *Insurance* Variable to the Explained Part-Detailed Decomposition Results

Year	Male-Based	Female-Based	Average-Based
2000	0.0490	0.0412	0.0450
2001	0.0292	-0.0093	0.0136
2002	0.0599	0.0126	0.0338
2003	0.1030	0.0349	0.0581
2004	0.0873	0.0705	0.0800
2005	0.0954	-0.0216	0.0394
2006	0.1440	0.1270	0.1369
2007	0.1984	-0.0843	0.0495
2008	0.1717	0.0241	0.0804