**The Impact of Trade Unions on the Gender Wage Gap:
Evidence from China**

Xinxin Ma
(Faculty of Economics, Hosei University)
and
Jie Cheng
(Institute of Population and Labor Economics,
Chinese Academy of Social Sciences)

December 2023

The Impact of Trade Unions on the Gender Wage Gap: Evidence from China

Xinxin Ma and Jie Cheng[*]

Abstract

Using national longitudinal survey data from the China Family Panel Studies from 2010 to 2020, this study explores union effects on the gender wage gap in China. The results demonstrate that the union wage premium is greater for women than men; the union wage premium beneficial for women in the public sector is greater than that in the private sector. The gender gap in the probability of obtaining union membership is insignificant for both the public and private sectors. Discrimination against women among the non-union group is the main factor generating the gender wage gap for both the public and private sectors, and the effect in the public sector is greater than that in the private sector. Additionally, the gender gap in unionism reduces the gender wage gap in the public sector while it widens the wage gap in the private sector, and the endowment differences reduce the gender wage gap in both the public and private sectors.

1. Introduction

Global labor markets share two common features. The first is the existence of trade unions (hereafter, unions), which remain in many countries. Unions can protect union members through collective bargaining and considerably increase the wage levels of disadvantaged groups (e.g., low-wage workers), which may reduce the wage gap (Lewis, 1963; Freeman, 1980; Card, 1996; DiNardo et al., 1996; Fortin and Lemieux, 1997). Numerous empirical studies have examined union wage premiums in developed (Chang and Huang, 2016; Herzer, 2016; Farber et al., 2021; Kulkarni and Hirsch, 2021; Oberfichtner et al., 2020; Masso et al., 2022; Tober, 2022) and developing countries (Gunderson, 2016; Casale and Posel, 2010; Kerr and Wittenberg, 2021), including China (Yao and Zhong, 2013; Li and Xu, 2014; Gunderson et al., 2015; Liu et al., 2018; Booth et al., 2022). Second, gender wage gaps exist in labor markets in both developing and developed countries, which has attracted worldwide attention worldwide (Blau and Kahn, 2017; Biewen et al., 2020; Ge and Zhou, 2020; Iwasaki and Ma, 2020; Ma, 2021, 2022; Masso et al., 2022). Although many countries have implemented employment equality and family policies to reduce discrimination against women in the workplace, gender wage gaps remain worldwide.[1]

Because the proportion of low-wage workers is higher for women than men and unions are expected to improve the work conditions for low-wage employees through the negation of increasing wages and enforcing the implementation of labor policies (e.g., the minimum wage and parental leave policies), female workers may obtain more benefits from union membership than male workers. Therefore, unions are assumed to affect the gender wage gap. This study focuses on the impact of unions on the gender wage gap in China, a country with the largest number of male and female workers worldwide, and the expansion of the gender wage gap in the past two decades (Iwasaki and Ma, 2020).

Although numerous empirical studies have revealed that trade unions influence income inequality (Card, 1996; Herzer, 2016; Farber et al., 2021; Tober, 2022), studies

---

[1] For the current empirical studies on the gender wage gap, please refer to Blau and Khan (2017), Ge and Zhou (2020), and Meara et al. (2020) for the US; Biewen et al. (2020) for German; Masso et al. (2022) for Estonia; and Iwasaki and Ma (2020) and Ma (2021, 2022) for China.

on the effects of unions on the gender wage gap are scarce. Additionally, while some studies have focused on this issue, most have been conducted in developed countries (Even and Macpherson, 1993; Dorion and Riddel, 1994; Aidt and Tzannatos, 2002; Schäfer and Gottschall, 2015; Oberfichtner et al., 2020). Only Mao et al. (2016) and Liu et al. (2018) have focused on China. Subsequently, several issues must be discussed further.

Using national longitudinal survey data from the China Family Panel Studies from 2010 to 2020, this study explores union effects on the gender wage gap in China. The results demonstrate that the union wage premium is greater for women than men; the union wage premium beneficial for women in the public sector is greater than that in the private sector. The gender gap in the probability of obtaining union membership is insignificant for both the public and private sectors. Discrimination against women among the non-union group is the main factor generating the gender wage gap for both the public and private sectors, and the effect in the public sector is greater than that in the private sector. Additionally, the gender gap in unionism reduces the gender wage gap in the public sector while it widens the wage gap in the private sector, and the endowment differences reduce the gender wage gap in both the public and private sectors.

This study contributes significantly to the existing literature in three ways. First, although Mao et al. (2016) and Liu et al. (2018) estimated the union wage premium in China using cross-sectional survey data and did not address endogeneity issues,[2] their results might have a measurement bias. This study is the first to estimate union wage premiums in China based on six waves of national longitudinal data from 2010 to 2020. We use a lagged variable (LV) model and fixed effects (FE) and random effect (RE) models to address reverse causality and individual heterogeneity problems. We also use the Heckman two-stage method to address sample selection bias. Thus, this study provides robust evidence of union wage premiums in China.

Second, referring to a new decomposition method (hereinafter the D-R method; Doiron and Riddell, 1994), we distinguishe the union effects on wages into three

---

[2] For example, the endogeneity problem occurs when there exists an individual heterogeneity (e.g., unobservable ability, personality, preference) or reversed casaulity issue (Wooldridge, 2020).

components (discrimination against women, endowment difference in wage structure among union and non-union groups, and difference in unionism) in the formation of the gender wage gap. Only two studies (Mao et al., 2016; Duguet and Petit, 2017) have challenged this issue using the D-R method. However, they did not address endogeneity issues. Consequently, this study is the first to examine the effects of these three components while considering endogeneity issues.

Third, Blanchfloer and Bryson (2010) and Rosenfeld and Denice (2019) reported that union wage premiums differ between the public and private sectors. Additionally, the implementation of employment equality policies and wage-setting systems differs between the two sectors (Ma and Li, 2022). Therefore, the effects of unions on the gender wage gap may differ between sectors. However, no study has explored the effects of these three components on the gender wage gap in the public and private sectors separately, and this study is the first to compare the differences in the effects of these three components between the two sectors.

The remainder of the paper is structured as follows: Section 2 intoduces the situations of trade unions in Chinese as the institutional background of this empirical study. Section 3 summarizes the related empirical studies on the issue and introduces the channels to explain the impact of trade unions on genderwage gap. Section 4 describes the data and model. Section 5 reports the results of descriptive statistics, and Section 6 presents and discusses the empirical results. Section 7 concludes this study.

2. Institutional Background: Trade Union in China

The functions of trade unions in China are unlike those in Western counties, and they have changed with the state-owned enterprise (SOE) reform. During the planned economic period of 1949–1977, the national All-China Federation of Trade Unions (ACFTU) established branches at the regional or industrial levels, and regional unions managed industry-level unions (Guo and Dai, 2022). The Chinese government promulgated the first *Trade Union Law* in June 1950. The *Resolution on the Work of the All-China Federation of Trade Unions*, published on December 22, 1951, stated the

following:

> "*It is necessary to make all trade union workers further clearly understand the party's importance to trade unions, and each branch of the ACFTU at all levels must work under the unified leadership of the committees of Communist Party of China (CPC) at the same level….Under the people's democratic system, the most basic and important task of trade unions is to organize and educate workers to increase labor productivity, ensure the completion of the national production plan and strive to overfulfill; on the basis of improving the production, often care for the daily benefits of workers, provide the serves to fulfill the needs of workers , and lead the workers to struggle for the socialism.*"

According to the regulations and laws, the union branch of the ACFTU in each work unit (e.g., government organizations and corporations) did not have the right to undertake collective bargaining with employers for workers' wage levels because the central government managed the wage-setting.

The Chinese government has implemented market-oriented reforms since 1978 and enforced the reform of SOEs (to promote the privatization of middle- and small-sized SOEs) since the end of the 1990s (Lin et al., 1994; Lin et al., 2020). The government has given more autonomy to wage setting and employment in SOEs, and simultaneously, the government promoted private-sector development. Privately owned and foreign-owned enterprises (POEs) and foreign-owned enterprises (FOEs) have developed considerably since the 1990s. With the progress of market-oriented reforms, labor disputes regarding wage levels and employment have increased in China. To address these new problems in the labor market, the Chinese government promulgated the Second *Trade Union Law* in April 1992, the *Labour Law of the People's Republic of China* in 1995, and the *Labour Contract Law of the People's Republic of China* in 2008. These regulations state that "*labor unions shall take measures to promote the implementation of the Labor Contract Law and the development of harmonious and stable employment relationships.*" The 24th

meeting of the Committee of the Ninth National People's Congress passed a revision of the *Trade Union Law* on October 27, 2001. Article 2 of the new *Trade Union Law* adds the provision that "*all organizations of the ACFTU represent the interests of employees and safeguard the legitimate rights and interests of employees in accordance with the law;*" Article 6 adds the provision that "*protecting the legitimate rights and interests of employees are the basic responsibilities of the ACFTU.*" The eligible units of these regulations include all enterprises in the public and private sectors (You, 2017; Guo and Dai, 2022).

3. Literature Review

3.1 Three Channels of the Effects of Unions on Gender Wage Gaps

Regarding the union effects on the gender wage gap, three components can be considered. First, unions can affect wage setting through negation with employers. When unions increase the wage levels of female union members (most of whom are low-wage workers), this may reduce the gender wage gap among union members. However, according to the taste-based discrimination hypothesis (Becker, 1957), when discrimination against female workers increases among non-member groups, the union wage premium on the overall gender wage gap may become unclear (discrimination against the effect of non-member women).

Second, an employer may set wage levels based on employee productivity (Becker, 1964). When a male worker's human capital (e.g., education and years of work experience) is greater than that of a female worker, a gender wage gap may arise (endowment difference effect).

Third, when there is a gender gap in unionism (e.g., the union density rate is lower for women than for men), a gender wage gap may arise (unionism difference effect; Even and Macpherson,1993; Dorion and Riddel, 1994; Farber et al., 2021)

Therefore, from an economic-theoretical perspective, the union effect on the gender wage gap remains unclear. Thus, an empirical study should be conducted to investigate the effect of unions on the gender wage gap.

The policy implications differ for the three channels above; for example, when the difference in the human capital endowment is the main component, policies to reduce the education gap and work-life balance policies are expected to reduce the wage gap; when discrimination against women is the main component, the government should promote employment equality policies in the workplace; and when the unionism gap is the main component generating the gender wage gap, the policy to expand union coverage among women is expected to reduce the wage gap. Therefore, distinguishing the three components and comparing their effect magnitudes is important for policymaking, and this study addresses this issue.

3.2 Empirical Studies on the Union Effects on Gender Wage Gap

Some studies have explored the effect of unions on the gender wage gap based on a wage function by using an interaction of the union indicator and a female dummy variable, and the empirical results are mixed. For example, Doiron and Riddell (1994), Reily (1995), Aidt and Tzannatos (2002), Ma et al. (2016), and Liu et al. (2018) found that the union wage premium is greater for women than for men, which reduces the gender wage gap. Whereas Oberfichtner et al. (2020) reported that the effects of collective bargaining (sector- and firm-level unions and work councils) on the gender wage gap in Germany are insignificant. Schafer and Gottschall (2015) used a survey that included 24 European countries and found the effects of collective bargaining coverage, centralization of wage bargaining, and the level at which collective bargaining is insignificant in the gender wage gap. Casale and Posel (2010) also reported that the gender wage gap among union members was greater than among non-members in South Africa.

To explore the channels of the effects of unions on the gender wage gap, the traditional Blinder-Oaxaca method (Blinder, 1973; Oaxaca, 1973) (hereinafter the B-O method) and the extension B-O decoding method were used.

The traditional B-O method can explore the effects of two components: (1) unexplained components (e.g., discrimination against women) and (2) the explained component (e.g., educational attainment gap) on the gender wage gap. Macpherson

(1993) decomposed the gender wage gap in the US and found that the explained component is the main factor generating the wage gap in union member groups. They also decomposed the change in unionism (union density rate) from 1973 to 1988 and found that the unexplained component was the main factor explaining the decline in unionism. Ma et al. (2016) found that differences in union wage premiums reduce the gender wage gap, whereas differences in union density widen the wage gap.

However, the B-O method addresses unions as an exogenous variable in wage functions and cannot simultaneously examine the effects of the explained and unexplained components among union members and non-members. Doiron and Riddell (1994) developed a new decomposition method (D-R method) to investigate three components of the gender wage gap: (1) the unexplained component in the wage structure that is related to discrimination in the workplace (discrimination effect); (2) the explained component in the wage structure (endowment difference effect); and (3) the difference in participation in trade unions (unionism effect). The D-R decomposition method can also distinguish price and endowment effects among union members and non-members; thus, it can provide detailed evidence of union effects. Only two empirical studies have used the D-R method to investigate this issue. Duguest and Petit (2006) used the D-R method to investigate union effects on the gender wage gap in France. They find that all three components contribute to generating a gender wage gap for all workers; the endowment difference effect is the greatest (0.084), while the unionism effect (0.015) is the smallest. Ma et al. (2016) used data from the Chinese General Social Survey of 2006 and found that all three components contribute to generating the gender wage gap: the discrimination effect is greatest (78.698%), and the unionism effect (1.845%) is the smallest.

As all previous studies used cross-sectional survey data and did not address the issue of heterogeneity, there might be bias in these results. Additionally, they do not consider the differences in the effects of unions between the public and private sectors. This study aims to fill these gaps in the literature.

4. Methodology

4.1 Data and Variable Setting

This study used national longitudinal survey data from the China Family Panel Studies (CFPS) survey, which has been conducted by Peking University since 2010, and follow-up surveys were conducted. We used the six waves of 2010, 2012, 2014, 2016, 2018, and 2020 (CFPS of 2010–2020), which included all information (e.g., wages, union membership) in the analyses. The national baseline survey was officially launched in 25 provinces, municipalities, and autonomous regions (the most representative regions were covered by the CFPS), in which 14,960 households were successfully interviewed. Within these households, 33,600 adults and 8,990 youths were interviewed in the first wave.

The CFPS was used for two reasons. First, the CFPS data include an individual's union membership status, wages, attributes (e.g., education, years of work experience, gender, ethnicity), and work information (e.g., occupation, industrial sector, public or private sector), which can be used in the empirical study. Second, the CFPS comprises longitudinal data, which can be used to address part of the endogeneity issue and provide more robust empirical evidence.

The number of CFPS samples is 37,147 (2014), 36,892 (2016), 37,354 (2018), and 28,590 (2020). Non-agricultural workers were also analyzed in this study. The *People's Republic of China Labor Law* prescribes that the minimum working age in China is 16 years, and the oldest mandatory retirement age in the public sector is 60 years[3]; 16 and 60 years were considered the lower and upper age bounds, respectively. Samples from the agricultural industry sector, self-employed individuals, and those with abnormal and missing values were excluded.

The key dependent variable was the logarithm of hourly wages. Based on the questions "How much did you earn in the past 12 months?" and "How long did you work per week in the past year?" Information on annual wages and weekly working hours was also obtained. Based on the questionnaire items in the CFPS, wages are considered to be composed of basic wages, bonuses, pecuniary fringe benefits, and allowances, excluding

---

[3] The mandatory retirement age in the public sector is 50 years for female workers, 55 years for female cadres, and 60 years for male workers and cadres. We also used samples of workers aged 16–50 years for a robustness check, and the results are approximately similar to those reported in this study. These results are available upon request.

social insurance contributions. We calculate hourly wages based on work hours. To address the effect of inflation, wage levels were adjusted using the annual Consumer Price Index (CPI) published by the National Bureau of Statistics of China, with the CPI in 2010 as the standard.

Referring to previous studies, the individual attribute factors including education, years of work experience and its squared term, ethnicity (1=Han majority, 0=minority ethnic), urban household registration (*hukou*) (1=urban, 0=rural), marital status (1=have a spouse, 0=otherwise), health status (1=healthy, 0=otherwise), Communist Party of China (CPC) membership (1=CPC member, 0=non-CPC member), occupation (manager, technician, operator, clerk, other occupation), the industrial sector (manufacturing, traffic and information, retail trade, service, other industrial sectors), region (west, central and east), and year dummies (year dummy variables from 2010 to 2020) were used as control variables. The definitions and descriptive statistics of the variables are summarized in Appendix Table A1.

4.2 Model

First, we used a wage function to calculate the union membership wage premium. The ordinary least squares (OLS) method is expressed in Eq. (1):

$$lnW_i = a + \beta_U U_i + \beta_F F_i + \beta_{UF} U_i * F_i + \beta_{nH} \sum_1^n H_i + u_i \qquad (1)$$

where subscript i is an individual, U is a union membership dummy, F is a female dummy, $U \times F$ is an interaction term of union and female dummy variables, H represents the other factors (e.g., education, occupation) that may affect the wage levels, β indicates the coefficients of each factor, β_{UF} is the gender difference in the union wage premium when other factors are consistent, a is a constant, and u is an error term.

We use the Heckman two-stage method to address sample selection bias (Heckman, 1979) in Eq. (1). The first type of endogeneity is reverse causality (RC). For example, union participation may result from high union wage premiums. Subsequently, the lagged variable of the union membership dummy was used to address this issue. For example, union status in the prior survey year U_{t-1} (e.g., union membership in 2014) was used to

investigate its influence on wages in the current survey year (e.g., wages in 2016). The wage level in 2016 did not affect participation in trade unions in 2014. The LV model is expressed using Eq. (2):

$$lnW_{it} = a + \beta_U U_{it-1} + \beta_F F_{it} + \beta_{UF} U_{it-1} * F_{it} + \beta_{nH} \sum_1^n H_{it} + u_{it} \qquad (2)$$

The second concern is individual heterogeneity (Wooldridge, 2020). In Eqs. (1) and (2), u_{it} includes individual-specific and time-invariant factors (v_i) and idiosyncratic errors (ε_{it}). Individual heterogeneity may occur in the estimated results if v_i is maintained. The RE model is used to address this problem[4] and is expressed by Eq. (3):

$$lnW_{it} = a + \beta_U U_{it} + \beta_F F_{it} + \beta_{UF} U_{it} * F_{it} + \beta_{nH} \sum_1^n H_{it} + v_i + \varepsilon_{it} \qquad (3)$$

The RE probit regression model was used to examine the gender gap in the chances of obtaining union membership:

$$Pr(y^* = 1) = \Phi(b + \gamma_U U_{it} + \gamma_F F_{it} + \gamma_{UF} U_{it} * F_{it} + \gamma_M M_{it} > 0) \qquad (4)$$

where M represents the other factors that may affect the probability of obtaining the union membership; γ indicates the coefficients of each factor; b is a constant term; and γ_F represents the gender gap in unionism when other factors are held constant. We also re-examined the male and female subsamples and compared the differences in the determinants of union membership between the two groups.

Two decomposition models were used to investigate the effects of union membership on the gender wage gap. The first is the traditional B-O method. The Oaxaca-Ransom decomposition method (Oaxaca-Ransom, 1994) is used to address the index number issue

---

[4] When we used the FE model, the number of samples became small, and the time-invariant factors (e.g., years of education, gender, ethnicity) that are important variables for the generation of the gender wage gap dropped from the estimations. Therefore, we only report the results of the RE model in this study and used these results in the decomposition analyses. The results on the effect of trade unions from the FE model are approximately similar to those from the RE model. The results are available upon request.

in the B-O method.[5] This model is expressed by Eq. (5):

$$\overline{lnW}_m - \overline{lnW}_f = \beta^*(\bar{X}_m - \bar{X}_f) + (\beta^* - \beta_f)\bar{X}_f + (\beta_m - \beta^*)\bar{X}_f \qquad (5)$$

where β^* is a sex-neutral coefficient estimated based on wage functions using the entire sample, including women and men. $\beta^*(\bar{X}_m - \bar{X}_f)$ expresses the endowment difference effect, $(\beta^* - \beta_f)\bar{X}_f$ represents the gap caused by the too-low endowment return of women (known as "loss of women"), and $(\beta_m - \beta^*)\bar{X}_f$ represents the wage gap generated by the too-high endowment return of men (known as the "gain of men"). The sum of these two decomposition values represents the wage gap resulting from differences in the price effect, which relates to discrimination against women in the workplace.

The second one is the D-R decomposition method (Doiron and Riddell, 1994) to further decompose the gender wage gap into three parts: (1) the A component $[p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu}]$ is the gender gap in wage setting due to the explained component (e.g., education, years of work experience); (2) the B component $[p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu})]$ is the gender gap in wage setting due to the unexplained components. Component B is related to the wage-setting mechanism, which is usually used as an indicator of discrimination against women in the workplace (Oaxaca, 1973; Blinder, 1973); and (3) Component C $[(p_{mu} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu})]$ is the gender gap in unionism. The decomposition method is expressed as follows:

$$\overline{lnW}_m - \overline{lnW}_f = p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu}$$
$$+ p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu})$$
$$+ (p_{mu} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu}) \qquad (6)$$

where the subscript u expresses union members, nu represents non-members, and p_{fu}

---

[5] Neumark (1988) and Oaxaca and Ransom (1994) argue that the basic B-O method (Blinder, 1973, Oaxaca, 1973) has the "index number" problem (the estimated results may vary with the type of comparison group used).

is the proportion of union members in the female group. β_{mu} and β_{fu} are obtained from the male and female union members' wage functions, respectively; and β_{mun} and β_{fun} are obtained from the wage functions of male and female non-members, respectively.

Component C can be decomposed into two parts based on a counterpart calculation of the probability of obtaining union membership, as illustrated in Eq. (7):

$$p_{fu}^* = \frac{1}{N_f}\sum_i^N \Phi(Z_{if}\gamma_m) \tag{7}$$

where p_{fu}^* is an imputed value of the proportion of women who would become union members if their individual attributes (Z_{if}) had the same effect as men (γ_m). Then, the C component can be decomposed as:

$$(p_{mu} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu}) = (p_{mu} - p_{fu}^*)(\overline{lnW}_{mu} - \overline{lnW}_{mnu})$$
$$+ (p_{fu}^* - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu}) \tag{8}$$

Based on Eqs. (6) and (8), the union effect on the gender wage gap can be decomposed into four components:

(1) $[p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu}]$ represents the gender gaps in wage setting due to explained components in union member group (A1: $p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu}$) and non-member group (A2: $(1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu}$);

(2) $[p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu})]$ represents the gender gaps in wage setting due to unexplained components in union member groups (B1: $p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu})$) and non-member groups (B2: $(1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu})$);

(3) $[(p_{mu} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu})]$ expresses the gender gap in unionism due to the explained components (C1).

(4) $(p_{fu}^* - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu})$ represents the gender gap in unionism caused by an unexplained component (C2).

To compare the union effect on the gender wage gap between the public and private sectors, we also apply a decomposition analysis using public and private sector subsamples.

5. Results of Descriptive Statistics

5.1 Wage Distributions by Union Membership and Gender

Figure 1 displays the logarithm of the wage distribution by union membership and gender. First, the average wage level in the union member group is higher than that in the non-member group for both men (3.17 for union members, 2.47; non-members) and women (3.13 for union members, 2.14 for non-members), suggesting a positive union wage premium in China.

Second, there is a gender wage gap between union members and non-members. The calculated logarithm means of wages indicates that the raw gender wage gap in the union member group (3.17 for men, 3.13 for women) is smaller than that in the non-union group (2.47 for men, 2.14 for women), indicating that unions may contribute to reducing the gender wage gap. However, it should be noted that these results did not control for other factors (e.g., education and occupation).

[Figure 1 near here]

5.2 Gender Gap in Individual Attributes Among Union Members and Non-members

Table 1 summarizes the descriptive statistics of the variables by gender and union member/non-member. We calculated the gender gaps in the mean values of these variables and conducted the *t*-test for union members and non-members separately.

[Table 1 near here]

The results of the *t*-test indicate that the gender gaps in the mean values of the variables are significant in both union members and non-members, while the gender gaps differ among union members and non-members. For example, the gender gap in years of schooling is larger for the union members (1.10 years) than that for non-members (0.38 years); the gender gap in the proportion of occupying the technician job is larger for the union members (-19%) than for the non-members (-8%), while the gender gap in the proportion of CPC membership is smaller for union members (10%) than for non-members (29%). The results suggest that gender gaps in individual attributes may affect

opportunities to obtain union membership and the gender wage gap in the workplace. These variables were controlled for in the analyses.

5.3 Gender Gap In the Union Density Rate

Table 2 presents the gender gap in the union density rate in China from 2010 to 2020. We used the proportion of union members to indicate the union density rate in each year and group.

[Table 2 near here]

First, in general, the union density rate was greater for men (11.03%) than for women (9.48%) in the period of 2010–2020 and most years. The gender gap remained in the union density rate from 2010 to 2020.

Second, the union density rate differs between the public and private sectors. The union density rate in the public sector (29.91%) was greater than that in the private sector (4.65%) from 2010 to 2020, suggesting that unionism was considerably different between the two sectors during the same period.

Third, the gender gap in union density rate differs between the public and private sectors. The gender gap in the public sector (2.70%) was greater than that in the private sector (0.71%) from 2010 to 2020.

We assume that the gender gap in the union density rate may affect the gender wage gap. In the following section, we explore the effect of the gender gap in unionism on the gender wage gap using the D-R decomposition method.

6. Econometric Analysis Results

6.1 Gender Gap in Union Wage Premium

Table 3 presents the basic results for the wage functions based on the RE model. The interaction term of the union and women dummy variable is used to investigate the gender gap in the union wage premium. We performed estimations for the total samples (Column

1), the public sector (Column 2), and the private sector (Column 3).

[Table 3 near here]

First, union wage premiums remain, ranging from 6.4–15.0% (13.5% for the total, 6.4% for the public sector, and 15.0% for the private sector). This result is consistent with the literature on developed countries, including China. For example, Lewis (1990) reported that the union wage premiums in the US range from 10.0–25.0%, and Blanchflower and Bryson (2010) found that the union wage premiums in the UK ranged from 8.26–13.38%. Booth et al. (2022) reported that rural-urban migrants' union wage premiums in China ranged from 4.8–14.0%, while Ma et al. (2016) demonstrated that the union wage premium in China ranged from 7.2–23.1%.

Second, a gender wage gap remains, ranging from 11.0–27.3% (19.6% for the total, 11.0% for the public sector, and 27.3% for the private sector). Compared with the literature on China, the estimated results are similar to the result (13.2–25.7%) of Lee and Wei (2017), while smaller than (around 38%) those of Guo et al. (2021). This is greater than that in developed countries. For example, the estimated gender wage gap is 12.11–13.62% in the US (Meara et al., 2020) and 4.2–19.7% in Sweden (Magnusson and Nermo, 2017). The international comparison indicated that, although in the planned economy period, the gender wage gap was smaller due to the enforcement of implementing the Chinese government's equal employment policies (Gustaffson and Li, 2000; Ma, 2021), with progressive market-oriented reform, the gender wage gap widened in China, becoming greater than that in developed countries in the 2000s.

Third, for the entire sample, the union wage premium is greater for women than for men for the total sample. The results in Column 1 indicate that the union wage premium for women is greater by 7.7% compared to that for men. These results are consistent with those reported by Mao et al. (2016). The proportion of the low-wage group among women is greater than that among men (Li and Ma, 2015), and the union effect on wage rise is greater for the low-wage group than for the high-wage group (Card, 1996); therefore, the union wage premium for women is greater than that of men. However, although the gender gap in the union wage premium has a positive value for the total sample, it is

insignificant for both the public and private sectors.

Fourth, the union wage premium, gender wage gap, and the gender gap in the union wage premium differ between the public and private sectors (see Columns 2 and 3). All these are greater in the private sector than in the public sector. For example, the coefficient of the union dummy (union wage premium) is 0.092 and significant at 5% for the private sector, while it is insignificant for the public sector.

Robustness checks were also performed, and the results are presented in Table 4. We used six methods. First, we used the OLS method used in the existing studies. Second, we used the Heckman two-step method to address the sample selection bias. Third, we used the LV model to address the reverse causality issue. Fourth, we replaced the sample aged 16–60 with those aged 16–50. Fifth, we replaced the dependent variable of the hourly wage with the weekly wage. Lastly, considering that parents' backgrounds may affect their adult children's wage levels, we added mothers' and fathers' education to the control variables.

[Table 4 near here]

The results of the six steps confirm the findings in Table 3. For example, the results in Column 1 indicate that the union wage premium ranges from 11.7–19.2%, the gender wage gap ranges from 12.7–24.5%, and the gender gap in the union wage premium ranges from 7.4–12.7% points when the other factors are consistent. The results in Columns 2 and 3 also indicate that the union wage premium, gender wage gap, and gender gap in the union wage premium in the private sector are greater than those in the public sector.

6.2 Gender Gap in the Probability of Obtaining Union Membership

Table 5 presents the probability of obtaining union membership based on the RE model. The results demonstrate that the coefficients of the women dummy variables are negative for the total sample and the public and private sectors, while all are insignificant. The results indicate that when controlling for other factors, including workers' human capital and work-related factors (e.g., occupation, industry sector, and workplace ownership type), the gender difference in the chance of obtaining union membership was small.

[Table 5 near here]

We also used two methods to conduct robustness checks: (1) to replace the samples aged 16–60 with those aged 16–50 and (2) to add the mother and father's education variables as control variables. The results are summarized in Table 6 and confirm the findings.

[Table 6 near here]

6.3 Decomposition Results of the Gender Wage Gap Based on the O-R Method

Table 7 presents the decomposition results based on the O-R method. First, regarding the total effects of the unexplained and explained components, the influence on the formation of the gender wage gap is greater for the unexplained component than that for the explained component in both public and private sectors. The unexplained component widens the gender wage gap, while the explained effect reduces the wage gap in both sectors, suggesting that discrimination against women is the main component of the formation of the gender wage gap in China.

[Table 7 near here]

Second, in terms of the union effect, its contribution rate in the unexplained component is -1.2% for the total samples, -18.5% for the public sector, and 0.1% for the private sector, indicating that the gender gap in union wage premium reduces the wage gap in the public sector, while it widens the wage gap in the private sector; as a result, it slightly reduces the overall gender wage gap.

The contribution rate of unions in the explained component is 0.7% for the total sample, 1.3% for the public sector, and 0.2% for the private sector. This suggests that the gender gap in union density widens the wage gap in both the public and private sectors, and its effect in the public sector is greater than that in the private sector. This may be because the union density rate is lower among women and men, and the gender difference in union density in the private sector is smaller than in the public sector (see Table 2).

6.4 Decomposition Results of the Gender Wage Gap Based on the D-R Method

The decomposition results based on the D-R method are summarized in Table 8.

[Table 8 near here]

First, regarding the three main components (A, B, C), based on the results of Column 1 (total samples), the total contribution rate of component A is a negative value (-53.1%), while those of components B and C are positive values (148.8% for B, 4.8% for C). The results indicate that the unexplained components of wage setting (B) and unionism (C) widen the gender wage gap, whereas the explained component of wage setting (A) reduces it.

Second, in terms of each factor, (1) in component A, the contribution rate is a negative value for both union (A1) or non-union (A2) groups, and it is greater for the non-union member group (-45.0%) than the union group (-8.1%), suggesting that the gender gap in endowment (e.g., the years of schooling is longer for women than for men, the years of work experience is longer for men than for women, see Table 2), is likely to reduce the gender wage gap and its effect on non-members is greater than for union members.

(2) In terms of the B component, the contribution rate is a positive value for both union members (B1) and non-members (B2), and it is greater for non-members (136.3%) than for union members(12.5%). The results suggest that the discrimination against women widens the gender wage gap between union members and non-members, and its effect on the non-members is greater than on union members.

(3) Regarding component C, both the unexplained component (C2) and the explained component (C1) had positive values (5.5%), whereas the value of C1 (3.8%) was higher than that of C2 (0.6%). These results suggest that discrimination against women and the gender gap in endowment may result in a gender gap in the opportunity to obtain union membership, which widens the gender wage gap; the effect of the gender gap in the endowment effect is greater than that of the discrimination effect.

(4) In comparing the magnitude of the contribution rate of each factor, the unexplained component in non-members (B2) is greatest (136.3%), suggesting that discrimination against women among non-members is the main factor generating the

gender wage gap in China.

Third, comparing the public sector with the private sector (Columns 1 and 2), (1) the total contribution rate of component A is negative in both sectors, and the value in the public sector is greater than that in the private sector, suggesting that the explained components in wage-setting reduce the gender wage gap in both sectors, and its effect in the public sector is greater than that in the private sector. The total contribution rate of component B is positive in both sectors, and the value is greater for the public sector than for the private sector. This suggests that discrimination against women in the workplace widens the gender wage gap in both sectors, and the effect in the public sector is greater than that in the private sector. The direction of influence of component C differs between the two sectors: it has a negative value for the public sector and a positive value for the private sector, indicating that unionism reduces the gender wage gap in the public sector and widens the wage gap in the private sector. (2) To compare the magnitude of the contribution rate of each factor, the unexplained component in non-union group (B2) is greatest for both the public and private sectors, while the value is greater for the public sector (408.4%) than that for the private sector (169.6%), suggesting that discrimination against women in the non-union group is the main factor generating the gender wage gap in both sectors, and the effect is greater for the public sector.

7. Conclusion

This study explored the effects of unions on the gender wage gap in China. It is the first to decompose the gender wage gap into three components (wage structure, endowment, and unionism) using six waves of national longitudinal survey data from the CFPS from 2010 to 2020. It also compared the differences in the effects of the three components between the public and private sectors, which have not been examined in existing studies.

The following three conclusions were drawn. First, there is a union wage premium ranging from 6.4–15.0%, and it is greater for women than for men and greater in the public sector than in the private sector. Second, the gender gap in the probability of obtaining union membership is insignificant in both the public and private sectors. Third,

the decomposition results indicate that discrimination against women in the wage setting among non-union members is the main factor generating the gender wage gap and that the effect in the public sector is greater than in the private sector. The gender gap in unionism reduces the gender wage gap in the public sector while widening the wage gap in the private sector, suggesting that discrimination against women for the opportunity to obtain union membership in the private sector widens the overall gender wage gap in China.

Our findings have several practical implications for future research. First, the gender gap in union wage premiums among non-members considerably affects the overall gender wage gap. This may be because discrimination against women in wage settings among non-members is much more severe than discrimination against union members. These results are consistent with economic theories that state that unions mainly benefit union members and promote employment equality in the workplace, which may reduce discrimination against women among union members. Second, the empirical results indicated that the gender gap in union density widened the gender wage gap in the private sector. Therefore, to reduce the gender wage gap, the Chinese government should implement equal employment policies in the private sector, and the specific policy of expanding women's union membership in the private sector is also expected to reduce the gender wage gap.

Finally, this study has some limitations. We used a selection bias adjustment and LV and RE models to address some of the endogeneity issues in examining union wage premiums. However, further research is required on the causal relationship between unions and the gender wage gap. Moreover, unions also have spillover and threat effects on non-union members (Farber et al., 2021), and self-selection in unionism causes a sorting effect (Robinson, 1989a, 1989b). Research on these effects presents a new challenge in the future.

Despite these limitations, the current study, which took full advantage of national longitudinal data, provides insights into the union effects on the gender wage gap in China, an emerging market country with the largest number of male and female workers worldwide. It also provides new empirical evidence on the union effect on the gender

wage gap between the public and private sectors.

References

Aidt, T., &Tzannatos, Z. (2002). *Unions and collective bargaining: Economic effects in a global environment*. Washington D. C.: World Bank.

Becker, G. S. (1957). *The economics of discrimination*. Chicago: University of Chicago Press.

Becker, G. S. (1964). *Human capital: a theoretical and empirical analysis, with special reference to education*. New York: Columbia University Press.

Biewen, M., Fitzenberger, B., & Seckler, M. (2020). Counterfactual quantile decompositions with selection correction taking into account Huber/Melly (2015): An application to the German gender wage gap. *Labour Economics*, 67, 101927.

Blanchfloer, D.G., & Bryson, A. (2010). The wage impact of trade unions in the UK public and private sectors. *Economica*, 77(305), 92–109.

Blau, F. D., & Kahn, L. M. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature*, 55(3),789–865.

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimation. *Journal of Human Resources*, 8, 436–455.

Booth, A., Freeman, R., Meng, X., & Zhang, J. (2022). Trade unions and the welfare of rural-urban migrant workers in China. *Industrial and Labor Relations Review*,75(4), 974–1000.

Card, D. (1996). The effect of unions on the structure of wages: A longitudinal analysis. *Econometrica*, 64(4), 957–979.

Casale, D., & Posel, D. (2010). Unions and the gender wage gap in South Africa. *Journal of African Economies*, 20(1), 27–59.

Chang, J., & Huang, H. (2016). Trade unions, unemployment, economic growth, and income inequality. *Macroeconomic Dynamics*,20(1), 404–428.

DiNardo, J., Fortin, N. M., & Lemieux, T. (1996). Labor markets institutions and the distribution of wages, 1973–1992: A semiparametric approach. *Econometrica*, 64,1001–1044.

Dorion, D. J., & Riddel, W. C. (1994). The impact of unionization on male-female earning differences in Canada. *Journal of Human Resources*, 29(2), 504–534.

Duguest, E., & Petit, P. (2007). Does the presence of unions in establishments reduce gender wage gap? An econometric analysis. *EcoMod 2007*, 23900066.

Even, W. E., & Macpherson, D. A. (1993). The decline of private-sector unionism and the gender wage gap. *The Journal of Human Resources*, 28(2), 279–296.

Farber, H. S., Herbst, D., Kuziemko, I., & Naidu, S. (2021). Unions and inequality over the twentieth century: New evidence from survey data. *The Quarterly Journal of Economics*, 136(3),1325–1385.

Fortin, N. M., & Lemieux, T. (1997). Institutional changes and rising wage inequality: Is there a linkage? *Journal of Economic Perspectives*, 11 (2), 75–96.

Freeman, R. B. (1980). The exit-voice tradeoff in the labor market: Unionism, job tenure, quits and separations. *The Quarterly Journal of Economics*, 94(4), 643–673.

Ge, S., & Zhou, Y. (2020). Robots, computers, and the gender wage gap. *Journal of Economic Behavior and Organization,* 178, 194–222.

Gunderson, M., Lee, B. Y., & Wang, H. (2016). Union pay premium in China: An individual-level analysis. *International Journal of Manpower*, 37(4), 606–627.

Guo, Q., Chen, S., & Zeng, X. (2021). Does Fintech narrow the gender wage gap? Evidence from China. *China & World Economy*, 29(4),142–166.

Guo, H., & Dai, W. (2022). Original aspiration and mission: Historical review and experience of Chinese trade unions participating in national governance. *Journal of Beijing Federation of Trade Unions Cadre College*, 37 (4),53–62 (in Chinese).

Gustafsson, B., & Li, S. (2000). Economic transformation and the gender earnings gap in urban China. *Journal of Population Economics*, 13, 305–329.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, 47（1），153–161.

Herzer, D. (2016). Unions and income inequality: A panel cointegration and causality analysis for the United States. *Economic Development Quarterly*, 30(3), 267–274.

Iwasaki, I., & Ma, X. (2020). Gender wage gap in China: A large meta-analysis. *Journal for Labor Market Research*, 54, 17.

Kerr, A., & Wittenberg, M. (2021). Union wage premia and wage inequality in South Africa. *Economic Modeling*, 97, 255–271.

Kulkarni, A., & Hirsch, B. (2021). Revisiting union wage and job loss effects using the displaced worker surveys. *Industrial and Labor Relations Review*, 74(4), 948–976.

Lee, J., & Wei, D. (2017). Wage structure and gender earnings differentials in China and India. *World Economy*, 97, 313–329.

Lewis, H. G. (1963). *Unionism and relative wages in the United States*. Chicago: The University of Chicago Press.

Lewis, H. G. (1990). Union/nonunion wage gaps in the public sector. *Journal of Labor Economics*, 8(1), 260–328.

Li, M., & Xu, J. (2014). Who benefit from China's trade union? *Economics Research Journal*, 5, 49–62 (in Chinese).

Li, S., & Ma, X. (2015). Impact of minimum wage on gender wage gaps in urban China. *IZA Journal of Labor and Development*, 4, 20.

Lin, K. J., Lu, X., Zhang, J., & Zheng, Y. (2020). State-owned enterprises in China: A review of 40 years of research and practice. *China Journal of Accounting Research*, 13, 31–55.

Lin, Y., Cai, F., & Li, Z. (1994). *Miracle development strategy and economic reform in China*. Shanghai: Shanghai People Publishing (in Chinese).

Liu, J., Xing, C, & Ge, Y. (2018). Does union membership reduce gender earnings differentials? Evidence from employer–employee matched data in China. *Pacific Economic Review*, 25,102–117.

Ma, X. (2021). *Female employment and gender gap in China*. Singapore: Springer.

Ma, X. (2022). Internet use and gender wage gap: Evidence from China. *Journal for Labor Market Research*, 56, 15.

Ma, X., & Li, S. (2022) Enterprise ownership reform and wage gaps between public and private sectors. In X. Ma & C. Cheng (Eds.) *Growth Mechanism and Sustainable Development of Chinese Economy: Comparison with Japanese Experiences*, Singapore: Palgrave Macmillan.

Mao, X., Liu, J., & Zhang, J. (2016). Can Chinese union reduce the gender wage gap? *Economic Perspectives*, 5, 26–36 (in Chinese).

Magnusson, C., & Nermo, M. (2017). Gender, parenthood and wage differences: The importance of time-consuming job characteristics. *Social Indicator Research*,131,797–816.

Masso, J., Meriküll, J., & Vahter, P. (2022). The role of firms in the gender wage gap. *Journal of Comparative Economics*, 50, 454–473.

Meara, K.. Pastore, F., & Webster, A. (2020). The gender pay gap in the USA: A matching study. *Journal of Population Economics*, 33, 271–305.

Neumark, D. (1988). Employer's discriminatory behavior and the estimation of wage discrimination. *Journal of Human Resources*, 23(3), 279–295.

Oaxaca, R. L.(1973). Male-female wage differentials in urban labor markets. *International Economic Review*, 14(3), 693–709.

Oaxaca, R. L., & Ransom, M. R. (1994). On discrimination and the decomposition of wage differentials. *Journal of Econometrics*, 61(1), 5–21.

Oberfichtner, M., Schnabel, C., & Marina, T. (2020). Do unions and works councils really dampen the gender pay gap? Discordant evidence from Germany. *Economics Letters*,196, 109509.

Robinson, C. (1989a). Union endogeneity and self-Selection. *Journal of Labor Economics*, 7(1), 106–112.

Robinson, C. (1989b). Union wage effects. *Journal of Political Economy*, 97(3), 639–667.

Rosenfeld, J., & Denice, P. (2019). What do government unions do? Public sector unions and nonunion wages, 1977–2015. *Social Science Research*, 78, 41–56.

Reily, B. (1995). Union and gender wage gap estimates for young workers in Ireland: A note. *The Economics and Social Review*, 26(2), 221–231.

Schäfer, A., & Gottschall, K. (2015). From wage regulation to wage gap: how wage-setting institutions and structures shape the gender wage gap across three industries in 24 European countries and Germany. *Cambridge Journal of Economics*, 39(2), 467–496.

Tober,T. (2022). European institutional integration, trade unions and income inequality. *Social-Economic Review*, 20(1), 351–371.

Wooldridge, J. M. (2020). *Econometric analysis of cross section and panel data*. Cambridge: The MIT Press.

Yao, Y., & Zhong, N. (2013). Unions and workers' welfare in Chinese firms. *Journal of Labor Economics*, 31(3), 633–666.

You, Z. (2017). On some quantitative studies into Labor Union in China. *Journal of Southeast University (Philosophy and Social Science)*, 19(5), 60–66 (in Chinese).

Table 1 Gender Gap in Individual Attirbutes among Union Members and Non-members

	(1)Union members				(2)Non-members			
	Men	Women	G1=M-F	t-test	Men	Women	G2=M-F	t-test
Education	12.81	13.91	-1.10	***	10.48	10.85	-0.38	***
Experience	26.09	21.46	4.63	***	23.14	20.78	2.36	***
Han ethnicity	0.97	0.97	0.00		0.96	0.95	0.01	**
Health	0.28	0.24	0.04	***	0.48	0.41	0.07	***
Urban	0.95	0.97	-0.02		0.46	0.77	-0.31	***
Married	0.88	0.85	0.03	***	0.42	0.76	-0.34	***
Party	0.31	0.21	0.10	***	0.38	0.09	0.29	***
Occupation								
Manager	0.10	0.07	0.03	***	0.09	0.05	0.04	***
Technician	0.18	0.37	-0.19	***	0.12	0.20	-0.08	***
Clerk	0.20	0.20	0.00		0.13	0.13	0.00	
Operator	0.38	0.15	0.23	***	0.45	0.23	0.22	***
Other occupations	0.13	0.21	-0.08	***	0.20	0.40	-0.20	***
Industrrial sector								
Manufacture	0.38	0.30	0.08	***	0.37	0.31	0.06	***
Traffic and information	0.08	0.04	0.04	***	0.11	0.04	0.07	***
Retail	0.05	0.12	-0.07	***	0.10	0.23	-0.12	***
Service	0.25	0.39	-0.14	***	0.20	0.29	-0.09	***
Other industries	0.24	0.15	0.09	***	0.22	0.13	0.09	***
Public sector	0.72	0.69	0.03		0.34	0.32	0.02	***
Region								

East	0.52	0.51	0.01	0.54	0.57	-0.03	***
Central	0.33	0.33	0.00	0.31	0.30	0.01	*
West	0.15	0.15	0.00	0.15	0.14	0.01	*
Obs.	1,429	889		7,248	5,053	14,619	

M: Mean 3.17
SD 0.81
F: Mean 3.13
SD 0.79

M: Mean 2.47
SD 1.00
F: Mean 2.14
SD 1.10
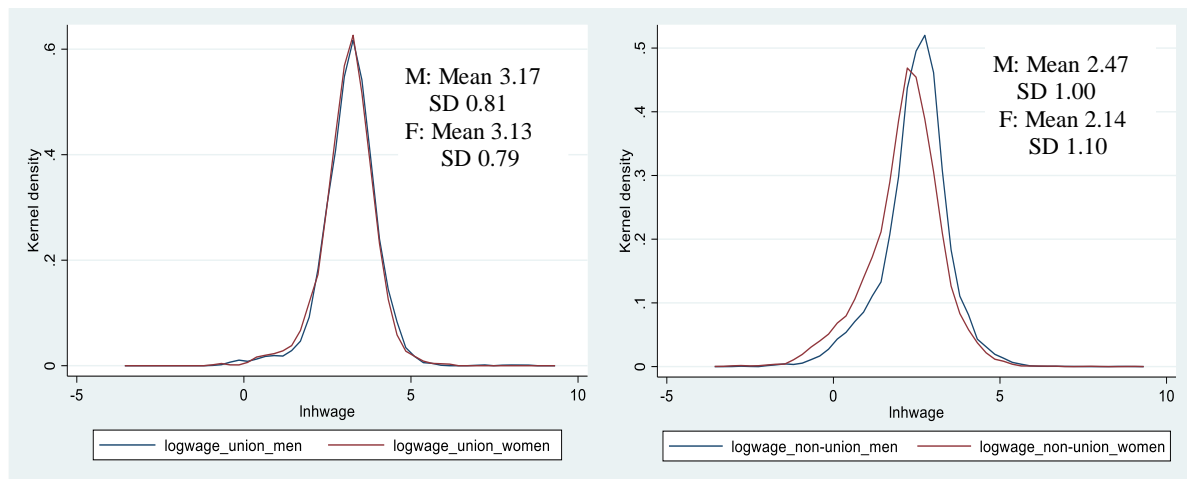
Figure 1. Kernel Density of Wage By Union Membership and By Gender

Source: Calculated based on the data from CFPS of 2010–2020.

Table 2. Gender Gaps in Union Density Rate

Unit: %

	Total(M+F)	Men	Wemen	Gap=M-F
(1) Total (Pub.+Pri.)				
2010	6.77	7.13	6.21	0.92
2012	7.77	6.00	6.68	-0.67
2014	5.97	6.00	5.91	0.10
2016	13.46	14.22	12.29	1.93
2018	11.57	14.17	11.78	2.40
2020	13.58	15.30	13.08	2.22
2010-2020	10.04	11.03	9.48	1.55
(2) Public				
2010	13.94	14.29	13.36	0.92
2012	25.06	24.60	25.86	-1.26
2014	17.54	17.41	17.77	-0.36
2016	40.89	44.49	35.59	8.90
2018	38.65	44.46	37.56	6.90
2020	45.19	47.95	44.43	3.52
2010-2020	29.91	31.49	28.79	2.70
(3) Private				
2010	3.63	3.84	3.30	0.54
2012	3.84	4.40	3.18	1.21
2014	2.83	2.82	2.83	-0.01
2016	5.70	5.82	5.51	0.31
2018	5.37	6.68	5.51	1.17
2020	6.11	7.02	5.80	1.22
2010-2020	4.65	5.13	4.42	0.71

Notes: Union density rate is the proprotion of union members among total samples in each group.
Source: Calculated based on the data from CFPS of 2010–2020.

Table 3. Gender Gaps in Union Wage Premium

	(1)Total			(2) Public			(3)Private		
	Coef.		z	Coef.		z	Coef.		z
Union	0.057	**	2.56	0.037		1.41	0.092	**	2.12
Female	-0.273	***	-16.25	-0.136	***	-4.93	-0.332	***	-16.19
Union×Female	0.077	**	2.26	0.027		0.66	0.058		0.90
No. of sample	14,619			5,801			8,818		
No. of group	8,269			2,943			5,724		
R-sq.									
Within	0.151			0.184			0.107		
Between	0.213			0.227			0.205		
Overall	0.229			0.235			0.215		
Log likelihood (Prob>chi2)									
BP test (Prob > chibar2)	1064.04 (p=0.000)			574.2 (p=0.000)			393.52 (p=0.000)		

Notes: *** $p<0.01$; ** $p<0.05$; Union × Female is the interaction term od union and female dummies; Control variables including years of schooling, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, occupation, industrial sector, region, and year dummies are controlled in three models; the public sector dummy is added in Model1; the results are not expressed in the table and available on request. All standard errors are adjusted as cluster-robust standard error clustering on the individual levels.
Source: Calculated based on the data from CFPS of 2014–2020.

Table 4. Robustness Checks on Gender Gaps in Union Wage Premium

	(1)Total			(2) Public			(3)Private		
	Coef.		z	Coef.		z	Coef.		z
(1) OLS									
Union	0.065	***	3.03	0.065	**	2.50	0.085	**	2.08
Female	-0.271	***	-18.48	-0.133	***	-5.6	-0.334	***	-18.1
Union×Female	0.127	***	3.91	0.043		1.06	0.107	*	1.79
(1) Heckman two stage									
Union	0.061	***	2.69	0.048	*	1.76	0.096	**	2.23
Female	-0.246	***	-10.98	-0.199	***	-5.5	-0.229	***	-7.60
Union×Female	0.119	***	3.43	0.068		1.57	0.062		0.99
Correction term	-0.275	*	-1.79	0.778	**	2.26	-1.102	***	-4.44
(2) LVt-1 method									
Union	0.073	***	2.60	0.123	***	3.70	0.033		0.62
Female	-0.260	***	-12.81	-0.126	***	-3.98	-0.336	***	-12.80
Union×Female	0.081	*	1.95	-0.008		-0.1	0.106		1.37
(3) Replace to samples aged 16-50 (RE)									
Union	0.033		1.24	-0.008		-0.27	0.114	**	2.19
Female	-0.289	***	-16.24	-0.156	***	-5.19	-0.344	***	-16.03
Union×Female	0.108	***	2.92	0.078	*	1.78	0.023		0.33
(4) Using monthly wage (RE)									
Union	0.054	***	2.98	0.053	**	2.39	0.061	*	1.87
Female	-0.311	***	-23.67	-0.226	***	-10.11	-0.347	***	-21.87
Union×Female	0.066	***	2.61	0.041		1.35	0.051		1.09
(5) Add parent's education variables (RE)									
Union	0.043	*	1.83	0.025		0.90	0.075	*	1.69
Female	-0.278	***	-15.45	-0.141	***	-4.77	-0.333	***	-15.26

Union×Female	0.074	**	2.07	0.032	0.75	0.038	0.57

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.1$; Union × Female is the interaction term od union and female dummies; Control variables including years of schooling, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, occupation, industrial sector, region, and year dummies are controlled in three models; the public sector dummy is added in Model1; the results are not expressed in the table and available on request. All standard errors are adjusted as cluster-robust standard error clustering on the individual levels.

Source: Calculated based on the data from CFPS of 2010–2020.

Table 5. Gender Gaps in the Probability of Obtaining Union Membership

	(1)Total		(2) Public		(3)Private	
	Coef.	z	Coef.	z	Coef.	z
Female	-0.066	-1.07	-0.064	-0.68	-0.038	-0.43
Control variabels	Yes		Yes		Yes	
No. of obs.	29,356		8,512		20,844	
No. of group	12,092		3,570		9,488	
R-sq.						
Within	0.195		0.195		0.195	
Between	0.243		0.243		0.243	
Overall	0.238		0.238		0.238	
Log likelihood (Prob>chi2)	-7429.60 (p=0.000)		-3673.31 (p=0.000)		-3372.19 (p=0.000)	

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.1$. The RE probit model is used in this study. Control variables including years of schooling, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, occupation, industrial sector, region, and year dummies are controlled in three models; the public sector dummy is added in Model1; the results are not expressed in the table and available on request. All standard errors are adjusted as cluster-robust standard error clustering on the individual levels.
Source: Calculated based on the data from CFPS of 2010–2020.

Table 6. Robustness Chekcs on Gender Gap in the Probability of Obtaining Union Membership

	(1)Total		(2) Public		(3)Private	
	Coef.	z	Coef.	z	Coef.	z
(1) Replace to samples aged 16-50 (RE)						
Female	0.009	0.12	0.033	0.32	0.001	0.01
Control variabels	Yes		Yes		Yes	
No. of obs.	24,108		8,512		17,457	
No. of group	10,258		3,570		8,100	
Log likelihood (Prob>chi2)	-5791.76 ($p=0.000$)		-2859.90 ($p=0.000$)		-2639.91 ($p=0.000$)	
(2) Replace parent's job to their education (RE)						
Female	-0.036	-0.50	0.002	0.02	-0.025	-0.25
Control variabels	Yes		Yes		Yes	
No. of obs.	22,507		6,314		16,193	
No. of group	9,210		2,627		7,310	
Log likelihood (Prob>chi2)	-5394.26($p=0.000$)		-2678.35 ($p=0.000$)		-2452.23 ($p=0.000$)	

Notes: The RE probit model is used in this study. Control variables including years of schooling, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, occupation, industrial sector, region, and year dummies are controlled in three models; the public sector dummy is added in Model1; the results are not expressed in the table and available on request. All standard errors are adjusted as cluster-robust standard error clustering on the individual levels.
Source: Calculated based on the data from CFPS of 2010–2020.

Table 7. Decomposition Results of Gender Wage Gap Based on the O-R Method

	(1) Total		(2) Public		(3) Private	
	Exlplained	Unexplained	Exlplained	Unexplained	Exlplained	Unexplained
Wage gap (value)	-0.018	0.222	-0.050	0.108	-0.0002	0.2858
Contribution rate (%)						
Total	**-8.6%**	**108.6%**	**-86.7%**	**186.7%**	**-0.1%**	**100.1%**
Union	**0.7%**	**-1.2%**	**1.3%**	**-18.5%**	**0.2%**	**0.1%**
Education	-10.3%	-29.1%	-105.4%	-21.5%	-4.1%	-28.9%
Exp.	0.5%	25.7%	53.1%	-61.5%	-1.7%	36.2%
Health	1.0%	4.7%	1.2%	11.7%	1.2%	4.7%
Ethnicity	0.2%	-48.6%	0.9%	-509.9%	0.2%	4.7%
Urban	-1.7%	-31.8%	-4.0%	78.0%	-0.9%	-31.1%
Married	-0.2%	21.2%	-4.1%	88.5%	0.0%	17.8%
Party	3.6%	-4.5%	19.6%	-34.0%	0.9%	-1.0%
Occupation	5.3%	-63.8%	-6.4%	-269.8%	8.1%	-37.5%
Inductry	7.0%	6.5%	-10.9%	15.5%	10.0%	2.3%
Public sector	0.3%	-23.4%			-2.9%	12.4%
Region	-2.8%	14.9%	2.6%	13.4%		
Year	-12.2%	1.6%	-34.6%	41.3%	-11.0%	-4.4%
Constants	0.0%	236.4%	0.0%	853.5%	0.0%	124.7%

*Note*s: Oaxaca-Ransom (1994) decomposition method is used.
Source: Calculated based on the data from CFPS of 2010–2020.

Table 8. Decomposition Results of Gender Wage GapBased on the D-R Method

	(1) Total		(2) Public		(3) Private	
	Value	Percenatge	Value	Percenatge	Value	Percenatge
Total gender wage gap	0.204	100%	0.058	100%	0.286	100%
A: Explained	-0.108	-53.1%	-0.108	-186.8%	-0.243	-85.1%
A1: Union	-0.017	-8.1%	-0.030	-52.1%	-0.005	-1.8%
A2: Non-union	-0.092	-45.0%	-0.078	-134.7%	-0.238	-83.3%
B: Unexplained	0.303	148.8%	0.270	464.9%	0.526	183.9%
B1: Union	0.026	12.5%	0.033	56.5%	0.041	14.3%
B2: Non-union	0.278	136.3%	0.237	408.4%	0.485	169.6%
C: Union membership	0.009	4.4%	0.103	-178.1%	0.003	1.2%
C1: Explained	0.008	3.8%	-0.005	-8.7%	0.003	1.2%
C2: Unexplained	0.001	0.6%	-0.098	-169.4%	0.000	0.0%

Notes: Doiron and Riddell (1994) decomposition method is used.
Source: Calculated based on the data from CFPS of 2010–2020.

Appendix Table A1. Defination and Descriptive Statistics of Variables (Total Samples)

	Definitions	Mean	SD	Min	Max
Union	1=trade union member, 0=non-member	0.159	0.365	0	1
logarithm of hourly wage	Calculated based on total wage and work hours	2.283	0.841	-2.303	8.041
Education	Years of schooling	11.086	4.072	0	22
Experience	Years of experience=age-6-years of schooling	22.340	11.853	0	54
Gender	1=female workers, 0=male workers	0.406	0.491	0	1
Ethnicity	1=Han majority, 0=ethnic minorities	0.959	0.198	0	1
Health	1=health status is very good or good, 0=otherwise	0.427	0.495	0	1
Urban	1=urban *hukou*, 0=rural *hukou*	0.769	0.421	0	1
Married	1=having a spouse,0=otherwise	0.778	0.416	0	1
Party	1= a member of Communist Party of China,0=non-CPC member	0.166	0.372	0	1
Occupation					
Manager	1=manager,0=otherwise	0.077	0.267	0	1
Technician	1=technician,0=otherwise	0.171	0.376	0	1

Clerk	1=clerk,0=otherwise	0.143	0.350	0	1
Operator	1=operator,0=otherwise	0.346	0.476	0	1
Other occupations	1=other occupation,0=otherwise	0.263	0.440	0	1
Industry sector		1.000			
Manufacture	1=manufactual industry sector,0=otherwise	0.343	0.475	0	1
Traffic and information	1=traffic and informationindustry sector,0=otherwise	0.080	0.271	0	1
Retail trade	1=retail industry sector,0=otherwise	0.139	0.346	0	1
Service	1=service industry sector,0=otherwise	0.250	0.433	0	1
Other industries	1=otherindustry sector,0=otherwise	0.188	0.390	0	1
Public sector	1=working in the public sector, 0=working in the private sector	0.397	0.489	0	1
Region					
East	1=eastern regions, 0=otherwise	0.550	0.498	0	1
Central	1=central regions, 0=otherwise	0.305	0.460	0	1
West	1=western regions, 0=otherwise	0.146	0.353	0	1
Year					
y2010	1=2010 survey year, 0=otherwise	0.161	0.367	0	1
y2012	1=2012 survey year, 0=otherwise	0.169	0.375	0	1
y2014	1=2014 survey year, 0=otherwise	0.178	0.382	0	1

y2016	1=2016 survey year, 0=otherwise	0.176	0.381	0	1
y2018	1=2018 survey year, 0=otherwise	0.179	0.383	0	1
y2020	1=2020 survey year, 0=otherwise	0.137	0.344	0	1
Observations	14619				

Source: Calculated based on the data from CFPS of 2010–2020.