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Trade unions and the gender wage gap: evidence from China

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ABSTRACT

While it is assumed that trade unions may influence the gender wage gap, evidence is scarce on this issue. This study investigates the issue in China using national longitudinal survey data from 2010 to 2020. The results reveal that the union wage premium is greater for women than for men. Furthermore, the union wage premium is more beneficial for women in the public sector compared to the private sector. The gender disparity in endowment return effect among non-union members is the primary factor contributing to the formation of the gender wage gap in both public and private sectors, with the effect being more pronounced in the public sector. Additionally, the gender disparity in unionism reduces the gender wage gap in the public sector while widening the wage gap in the private sector.

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Gender wage gap; discrimination; unionism; public and private sector

1. Introduction

Gender wage gaps exist in labor markets in both developing and developed countries, drawing worldwide attention (Biewen et al., 2020; Blau & Kahn, 2017; Ge & Zhou, 2020; Iwasaki & Ma, 2020; Masso et al., 2022). Notwithstanding the implementation of employment equality and family policies in numerous countries to reduce discrimination against women in the workplace, gender wage gaps persist globally.

Trade unions (hereafter unions) can protect their members through collective bargaining and significantly increase the wage levels of disadvantaged groups, such as lowwage workers, which may help reduce the wage gap (Card, 1996; DiNardo et al., 1996; Freeman, 1980; Freeman & Medoff, 1984; Lewis, 1963). Given that the proportion of lowwage workers is higher among women than men, unions are expected to improve working conditions for low-wage employees by negotiating higher wages and enforcing the implementation of labor policies such as minimum wage, employment equality, and parental leave policies. Consequently, female workers may benefit more from union membership than their male counterparts. Therefore, it is assumed that unions can influence the gender wage gap.

While numerous empirical studies have shown that unions influence income inequality (Card, 1996; Farber et al., 2021; Tober, 2022), research on the effects of unions on the

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gender wage gap is relatively scarce. Furthermore, while some studies have explored this issue, most of them have been conducted in developed countries (Aidt & Tzannatos, 2002; Even & Macpherson, 1993; Oberfichtner et al., 2020; Schäfer & Gottschall, 2015). There is a dearth of evidence from developing countries, including China (Liu et al., 2018; Mao et al., 2016).

This study aims to address three questions in the Chinese context: (i) Does a union wage premium exist, and if so, does it differ by gender? (ii) How do unions affect the gender wage gap? (iii) Do the union effects on the gender wage gap differ between the public and private sectors? We utilize six waves of national longitudinal data from 2010 to 2020 to mitigate the individual heterogeneity issue. Additionally, we employ a novel decomposition method to explore three channels that explain the association between unions and the gender wage gap.

We selected China as the focus of our empirical study for two primary reasons. First, China is a large developing country with numerous union members, and it also has a substantial female workforce. The gender wage gap in China has widened during the economic transition period (Iwasaki & Ma, 2020). While it is anticipated that unions may protect the rights of disadvantaged groups, such as female workers, and contribute to reducing the gender wage gap, there is a lack of empirical evidence on this matter in the Chinese context.

Second, China is also an emerging market economy. In China, the functions of unions have evolved with the transition of economic systems. Specifically, during the planned economic period from 1949 to 1977, as the central government managed wage-setting, the national All-China Federation of Trade Unions did not have the authority to engage in collective bargaining (H. Guo & Dai, 2022; You, 2017). Since 1978, the Chinese government has implemented market-oriented reforms and intensified the reform of state-owned enterprises (SOEs) since the late 1990s (K. J. Lin et al., 2020; Y. Lin et al., 1994). Simultaneously, the government promoted the development of the private sector. Privately owned enterprises (POEs) and foreign investment enterprises (FIEs) have significantly expanded since the 1990s. As market-oriented reforms progressed, labor disputes concerning wage levels and employment also increased in China. To address these new challenges in the labor market, the Chinese government enacted the Trade Union Law in April 1992, Labor Law of the People's Republic of China in 1995, and Labor Contract Law of the People's Republic of China in 2008. These regulations stipulate that "Labor unions should take measures to promote the implementation of the Labor Contract Law and the development of harmonious and stable employment relationships." These regulations apply to all companies in both public (e.g., SOEs) and private (e.g., POEs and FIEs) sectors. China can be used as a case study to compare the effects of unions on the gender wage gap between public and private sectors.

This study investigated the issue in China using national longitudinal survey data from 2010 to 2020. The empirical results revealed that the union wage premium is greater for women than for men, and the union wage premium is more beneficial for women in the public sector compared to the private sector. Using a new decomposition method, hereinafter referred to as the D-R method (Doiron & Riddell, 1994), we explored the influence of three channels on the gender wage gap: (1) endowment effect (gender disparity in human capital endowment) of wage setting among union and non-union members, (2) return effect (gender disparity in endowment return) of wage setting

among union and non-union members, and (3) unionism effect (gender disparity in union membership density). We found that the return effect of wage setting, including the discrimination against women in the workplace among non-union members, was the primary factor contributing to the formation of the gender wage gap in both public and private sectors, with the effect being more pronounced in the public sector. Additionally, the unionism effect reduced the gender wage gap in the public sector, widening the wage gap in the private sector.

This study makes significant contributions to the existing literature in three ways. First, it is the first study to investigates three channels of union effects on the gender wage gap in China from 2010 to 2020, based on the D-R method (Doiron & Riddell, 1994). Compared to the traditional Blinder-Oaxaca style decomposition method (hereafter B-O method) (Blinder, 1973; Oaxaca, 1973), the D-R decomposition approach can explore the detailed mechanisms of union effects on the gender wage gap.

Second, this study is the first to compare the differences in three channels of union effects on the gender wage gap between public and private sectors. While there remain differences in the implementation of employment equality policies and wage-setting systems between the two sectors (Démurger et al., 2012; Sławińska, 2021), no study has compared the channels of the impact of unions on the gender wage gap among the public and private sectors. This study can help bridge the gaps in the literature.

Third, it is the first to measure differences in union wage premiums in China while accounting for endogeneity issues.¹ To address concerns related to individual heterogeneity, we employed fixed effects (FE) or random effects (RE) model. We also used the Heckman two-stage method (Heckman, 1979) and the model with the lagged variable of union membership (LV model) to conduct robustness checks. Consequently, this study offers robust evidence regarding union wage premiums in China.

The remainder of the paper is structured as follows: Section 2 introduces three channels to explain the relationship and provides a summary of empirical studies on the issue. Section 3 describes the data and methodology used in the empirical analysis. Section 4 presents the results of descriptive statistics. Section 4 presents and discusses the empirical results of econometric analysis. Finally, Section 5 concludes the new findings and policy implications.

2. Literature review

2.1. Three channels of union effects on the gender wage gap

Regarding the union effects on the gender wage gap, three channels can be considered. The first channel is the gender disparity in human capital endowment (endowment effect). According to the human capital theory (Becker, 1964), workers' wages depend on their labor productivity, which is determined by their human capital. Numerous studies have demonstrated that the gender disparity in human capital endowment, such as education, work experience, and occupation, is the primary component of the gender wage gap (Blau & Kahn, 2017; Blinder, 1973; Oaxaca, 1973; Oaxaca & Ransom, 1994). The gender disparity in human capital endowment in either union or non-union

¹For example, the endogeneity problem occurs when there exists an individual heterogeneity (e.g., unobservable. ability, personality, preference) or reverse causality bias (Wooldridge, 2020).

members may contribute to the formation of overall gender wage gap. However, the gender disparity in human capital endowment may differ between union and non-union members. For instance, based on a Chinese national data from CFPS used in this study, the gender gap of years of schooling of union members is 1.10 years, which is larger than that of non-union members (0.38 years). Thus, the endowment effect on the gender wage gap may differ between union and non-union members.

The second channel is the gender disparity in endowment return (return effect), such as that in human capital endowment return (e.g., education return to wage) and in union wage premiums. The return effect is caused by the gender disparity in the wage setting mechanism, including discrimination against women in the workplace.

The union wage premium may have two effects on the gender wage gap. Unions can affect wage setting through collective negotiations with employers, leading to a positive union wage premium for both male and female members. As most female union members are low-wage workers who are easily influenced by the unions' collective negotiations, the union wage premium may be higher for women than for men. Consequently, unions may reduce the gender wage gap. Conversely, a discrimination against women in workplace may remain. When discrimination against women remains among union members, the increase in wage may be greater for male than female union members, despite similar individual characteristics, such as education and occupation. The discrimination may decrease women's union wage premium, which may generate the overall gender wage gap. Additionally, discrimination against women may be more severe for non-union members without protection from unions than for union members, which may widen the overall gender wage gap. The total effect of this channel on the gender wage gap is determined by the magnitudes of these two effects.

The third channel is the gender gap of union density, which is the gender disparity in the chance of obtaining union membership (unionism effect). The gender disparity in unionism occurs due to two components: (i) gender disparity in endowments and (ii) discrimination against women who participate in unions (Doiron & Riddell, 1994).

Robinson (1989a, 1989b) found a sorting effect of unions on gender disparity in endowments. Doiron and Riddell (1994), Farber et al. (2021), Freeman (1980), Freeman and Medoff (1984) demonstrated that in developed countries, such as the US and UK, low-wage, less-educated, and unskilled workers, Black people, and non-managers were more likely to join unions than high-wage, well-educated, and skilled workers, men, White people, and manager. As individual endowments, such as education attainment, race, ethnicity, and occupation, differ by gender, self-selection based on individual characteristics may lead to a gender disparity in unionism.

Furthermore, as most union members are men (Farber et al., 2021), they may prevent women from becoming union members if taste-based discrimination is present (Becker, 1957). The discrimination against women may reduce women's probability of obtaining union membership, leading to a gender disparity in unionism even when women's characteristics are similar to those of men (Doiron & Riddell, 1994).

2.2. Empirical studies on the union effects on the gender wage gap

Numerous studies have investigated the union wage premium, revealing complex empirical findings. Most empirical studies have identified positive union wage premiums in both developed (Bryson, 2014; Farber et al., 2021; Kulkarni & Hirsch, 2021; Masso et al., 2022; Oberfichtner et al., 2020; Tober, 2022) and developing countries (Casale & Posel, 2010; Gunderson et al., 2016; Kerr & Wittenberg, 2021), including China (Booth et al., 2022; Gunderson et al., 2016; M. Li & Xu, 2014; Liu et al., 2018; Ma, 2024; Yao & Zhong, 2013). However, the magnitude of the premium differed in these studies. For instance, Bryson (2014) revealed that the premium varies globally, ranging from 7% (Norway, Spain) to 34% (Brazil), with 10% and 17% for the UK and US, respectively. Farber et al. (2021) also reported that the premium in the US ranges from 10% to 20%. For the emerging market economies, Magda et al. (2016) indicated that in 2006, firm-level agreements yielded wage premiums of 9.7% and 16.0% for the Czech Republic and Poland, respectively, and ranged from 12.7% to 31.8% for Hungary. Moreover, industry-level agreements yielded wage premiums ranging from 11.2% to 33.7% for Poland and 18.3% to 43.6% for Hungary, while remaining insignificant for the Czech Republic. For China, the union wage premium ranged from 4.8% (Sun & Liu, 2015) to 52.0% (M. Li & Xu, 2014). In contrast, Bryson (2014) reported that the union wage premium was insignificant in Italy, the Netherlands, Sweden, France, and Germany.

Several empirical studies have explored the issue by employing a wage function that utilizes an interaction term between union and a female dummy variable, with mixed empirical results. For instance, Aidt and Tzannatos (2002), Doiron and Riddell (1994), Reily (1995), Liu et al. (2018), and Mao et al. (2016) found that the union wage premium is greater for women than for men, which reduces the gender wage gap. In contrast, Casale and Posel (2010) reported that the gender wage gap is greater among union members than among non-union members in South Africa, indicating that the unions may widen the gender wage gap. Additionally, Oberfichtner et al. (2020) reported that the effects of collective bargaining on the gender wage gap in Germany are insignificant. Schäfer and Gottschall (2015) used a survey that included 24 European countries and also found that the effects of collective bargaining coverage and centralization of wage bargaining on the gender wage gap are insignificant.

Some studies explored the channels of union effects on the gender wage gap based on the B-O method. For instance, Even and Macpherson (1993) decomposed the gender wage gap in the US and discovered that the unionism effect (gender disparity in union density) is the main factor generating the gender wage gap in union member groups. Mao et al. (2016) found that the return effect (gender disparity in union wage premium) reduces the gender wage gap in China, whereas the endowment effect widens the wage gap.

Doiron and Riddell (1994) developed a new decomposition method (D-R method) to explore the formation of the gender wage gap in three channels: (A) the return effects of wage setting among union and non-union members; (B) the endowment effects of wage setting among union and non-union members; and (C) the unionism effect. Only two empirical studies used the D-R method to explore the three channels of the union effects on the gender wage gap, which are most closely related to this study. Duguest and Petit (2007) found that in France, all three effects contribute to generating a gender wage gap; the endowment effect of wage setting is the greatest (0.084), while the unionism effect (0.015) is the smallest. Mao et al. (2016) used data from the Chinese General Social Survey of

2006 and found that in China, all three effects contribute to generating the gender wage gap: the return effect of wage setting is the greatest (78.698%), whereas the unionism effect (1.845%) is the smallest.

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

3. Empirical strategy

3.1. Data and variable setting

This study used national longitudinal data from the China Family Panel Studies (CFPS) survey, which was 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 33,598 adults and 8,990 youths were interviewed in the first wave.

The number of CFPS samples was 33,598 (2010), 35719 (2012), 37147 (2014), 36892 (2016), 37354 (2018), and 28,590 (2020). Non-agricultural workers were analyzed in this study. As 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, we considered 16 and 60 years to be 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. 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. We also constructed a binary variable of union membership (1= a union member, 0=non-union member) as a dependent variable in the probability function of obtaining union membership.

Referring to previous studies and economic theories, (1) the demographic factors including education, years of work experience and its squared term, gender (1=female worker, 0=male worker), ethnicity (1=Han majority, 0=minority ethnic), urban house-hold 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); (2) work-related factors including occupation (manager, technician, operator, clerk, other occupation), the industrial sector (manufacturing, traffic and information, retail trade, service, other industrial sectors); (3) region (west, central, and east); and (4) 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.

3.2. Model

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

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

where subscript *i* is an individual, *U* is a union membership dummy, *F* is a female worker dummy, $U \times F$ is an interaction term of union and female worker dummy variable, *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 disparity in the union wage premium when other factors are held consistent, *a* is a constant term, and *u* is an error term.

The concern with the OLS method is individual heterogeneity (Wooldridge, 2020). u_i in Equation (1) includes the unobservable individual effect (v_i) and idiosyncratic error (ε_{it}). Individual heterogeneity problems may occur if v_i remains as shown in Equation (2).

$$lnW_{it} = a + \beta_U U_{it} + \beta_F F_{it} + \beta_{UF} U_{it} \times F_{it} + \beta_{nH} \sum_{1}^{n} H_{it} + \nu_i + \varepsilon_{it.}$$
(2)

The FE or RE model is used to address this problem. The FE model allows arbitrary correlation between v_i and the explanatory variables (e.g., U, F, $U \times F$, H), whereas the RE model does not (Wooldridge, 2016). The FE or RE model is designed to calculate the parameter of each explanatory variable by using the gap between a variable at one time point and average value of that variable during the T period from 1 - t time years; v_i is excluded by the econometric analysis design. In Equation (2), t indicates the time year.

As results of time-invariant factors, such as the gender variable (F_{it}) , cannot be obtained in the FE model, and given the cruciality of the gender wage gap in this study, we mainly used the RE model as the baseline. The FE model was used to perform the robustness checks for the union wage premium.

We also used the Heckman two-stage method to address the sample selection bias and the LV model with the lagged variable of union in the prior survey year to address the reverse causality problem.

Second, the RE probit regression model was used to examine the gender gap in the probability of obtaining union membership:

$$\Pr(y^* = 1) = \Phi(b + \gamma_U U_{it} + \gamma_F F_{it} + \gamma_{UF} U_{it} \times F_{it} + \gamma_M M_{it} + \nu_i > 0),$$
(3)

where *M* represents the other factors that may affect the probability of obtaining union membership; γ indicates the coefficients of each factor; *b* is a constant term; and γ_F represents the gender disparity in unionism when other factors are held consistent.

Third, two decomposition methods were used to investigate the effects of union membership on the gender wage gap. The first one is the B-O style decomposition method (Blinder, 1973; Oaxaca, 1973) that is typically used in literature on gender wage gaps (e.g., Blinder, 1973; Duraisamy & Duraisamy, 2016; Gustafsson & Li, 2000; Neumark, 1988; Oaxaca, 1973; Oaxaca & Ransom, 1994; Rotman & Mandel, 2023). The B-O style method can explore the total endowment and return effects on the gender wage gap. This study used

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the Oaxaca-Ransom decomposition method (Oaxaca & Ransom, 1994) (hereafter, O-R method) to address the index number issue in the standard B-O method (Neumark, 1988; Oaxaca & Ransom, 1994). The O-R method is expressed by Equation (4):

$$\overline{lnW}_m - \overline{lnW}_f = \beta^* (\overline{X}_m - \overline{X}_f) + (\beta^* - \beta_f) \overline{X}_f + (\beta_m - \beta^*) \overline{X}_f, \qquad (4)$$

where X indicates a set of explanatory variables including union dummy variable in wage functions. β^* is a gender-neutral coefficient estimated based on the wage function using the entire sample, including women and men; β_m , β_f expresses the coefficients of X in men or women's wage function, respectively. $\beta^*(\bar{X}_m - \bar{X}_f)$ expresses the endowment 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 endowment return effect, which includes discrimination against female workers and unobservable factors, such as personality, risk aversion, and competitive preference.

Although the O-R method can investigate the total influences of the endowment and return effects on the gender wage gap, there are limitations. For instance, as the O-R method decomposes the gender wage gap based on the male and female wage functions, it cannot separately examine the endowment and return effects among union and non-union members. Moreover, the O-R method addresses unions as an exogenous variable in wage functions; thus, it cannot investigate the mechanism of the unionism effect and its effect on the gender wage gap. Subsequently, we used the D-R decomposition method (Doiron & Riddell, 1994) to further explore the union effects on the gender wage gap through three channels:

$$\overline{lnW}_{m} - \overline{lnW}_{f} = p_{fu}(\overline{X}_{mu} - \overline{X}_{fu})\beta_{mu} + (1 - p_{fu})(\overline{X}_{mnu} - \overline{X}_{fnu})\beta_{mnu}
+ p_{fu}\overline{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\overline{X}_{mn}(\beta_{mnu} - \beta_{fnu})
+ \left[\left(p_{mu} - p_{fu}^{*} \right) \left(\overline{lnW}_{mu} \overline{lnW}_{mnu} \right) \right] + \left(p_{fu}^{*} - p_{fu} \right) \left(\overline{lnW}_{mu} - \overline{lnW}_{mnu} \right),$$
(5)

where the subscript *u* represents union members, and *nu* represents non-union members. p_{mu} and p_{fu} are the proportion of union members among men and women, respectively; p_{fu}^* is the imputed proportion of union members among women when their individual endowments (X_{fu})had similar influences on the probability of obtaining union membership as those of men. β_{mu} and β_{fu} are the coefficients of X_{mu} and X_{fu} obtained from the male and female union members' wage functions, respectively; and β_{mun} and β_{fun} are the coefficients of X_{mnu} and X_{fnu} obtained from the separate wage functions of male and female non-union members. The union effects on the gender wage gap can be decomposed into three channels (components A, B, and C):

(1) Component A (endowment effect of wage setting): $[p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fnu})\beta_{mnu}]$ represents the gender disparity of wage setting owning to the gender difference in the endowment effect among union $(A1:p_{fu}(\bar{X}_{mu}-\bar{X}_{fu})\beta_{mu})$ and non-union members (A2: $(1-p_{fu})(\bar{X}_{mnu}-\bar{X}_{fnu})\beta_{mnu})$;

- (return (2) Component effect В in setting): wage $\left[p_{fu}\bar{X}_{mu}\left(\beta_{mu}-\beta_{fu}\right)+\left(1-p_{fu}\right)\bar{X}_{mn}\left(\beta_{mnu}-\beta_{fnu}\right)\right]$ represents the gender disparity of wage setting owing to the gender difference in the return effect among union $p_{fu}\bar{X}_{mu}(\beta_{mu}-\beta_{fu}))$ (B1: and non-union members (B2: $(1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu}));$ (3) Component C (unionism effect) represents the gender disparity in the probability
- (3) Component C (unionism effect) represents the gender disparity in the probability of obtaining union membership owing to the gender difference in the endowment $(C1:\left[\left(p_{mu}-p_{fu}^*\right)\left(\overline{lnW}_{mu}-\overline{lnW}_{mnu}\right)\right]\right)$ and return effects (C2: $\left(p_{fu}^*-p_{fu}\right)\left(\overline{lnW}_{mu}-\overline{lnW}_{mnu}\right)$.

4. Results of descriptive statistics

Figure 1 displays the logarithm of the wage distribution by union membership and gender. First, the average wage level for union members is higher than that for non-members for both men (2.75 for union members, 2.44 for non-members) and women (2.69 for union members, 2.24 for non-members), suggesting a positive union wage premium. Second, a gender wage gap exists among both union and non-union members. The calculated logarithm means of wages indicates that the raw gender wage gap in the union members (2.75 for men, 2.69 for women) is smaller than that in the non-union members (2.44 for men, 2.24 for women), indicating that unions may contribute to reducing the gender wage gap. However, these results did not control for other factors (e.g., education and occupation), which may affect wages.



Figure 1. Kernel density of wage by union membership and gender. (a) Union members, (b) Nonunion members. Notes: M: Men; F: Women.

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

The *t*-test results indicate significant gender disparities in the mean values of these factors for both union and non-union members, with differences observed between both groups. For instance, the gender disparity in years of schooling is greater among union members (1.10 years) compared to non-union members (0.38 years). The gender disparity in the proportion of occupying the technician job is larger for the union members (-19%) than for the non-union members (-8%), and the gender disparity in the proportion of CPC membership is smaller for union members (10%) than for non-union members (29%). The results suggest that gender disparities in individual characteristics may affect the probability of obtaining union membership and the gender wage gap. Thus, we controlled for these variables in the following analyses.

5. Results of econometric analysis

5.1. Gender disparity in union wage premium

Table 2 presents the basic results for the wage functions based on the RE model. The interaction term of the union and women dummy variable was used to investigate the

	Union members				Non-union 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	0.13	0.21	-0.08	***	0.20	0.40	-0.20	***
Industrial 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	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	

Table 1. Gender disparities in individual characteristics among union and non-union members.

Notes: ****p* < 0.01; **p* < 0.1.

	(1) Nation			(2) Public	(2) Public Sector			(3) Private Sector	
	Coef.		z	Coef.		z	Coef.		z
Union	0.057	**	2.56	0.037		1.41	0.092	**	2.12
Woman	-0.273	***	-16.25	-0.136	***	-4.93	-0.332	***	-16.19
Union×Woman	0.077	**	2.26	0.027		0.66	0.058		0.90
Control variables	Yes			Yes			Yes		
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		
BP test (Prob > chibar2)	1064.0	04 (p =	0.000)	574.2	(p = 0.0)	00)	393.5	2 (<i>p</i> = 0.0	000)

Table 2. Gender disparities in union wage premium.

Notes: Union×Woman, interaction term of union and female worker dummy variables; BP test, Breusch and Pagan Lagrangian multiplier test for random effects. Control variables compose of demographic factors such as education, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, work-related factors such as occupation, industrial sector, region, and year dummy variables; the public sector dummy variable was added for all samples in Column 1. All standard errors were adjusted as cluster-robust standard error clustering on the individual level.

****p* < 0.01; ***p* < 0.05.

gender disparity in the union wage premium. We performed estimations for the nation (Column 1), public sector (Column 2), and private sector (Column 3). The results of the Breusch and Pagan Lagrangian multiplier tests indicate that the RE model is more appropriate than the OLS method.

First, union wage premiums remain, ranging from 6.4-15.0% (13.5%, 6.4%, and 15.0% for the nation, public sector, and private sector, respectively).² The results indicate a positive union wage premium in the Chinese context.

This study's findings are consistent with those in the literature on developed countries. For instance, Lewis (1990) reported that the union wage premiums in the US range from 10.0–25.0%. Blanchflower and Bryson (2010) demonstrated that the union wage premiums in the UK ranged from 8.26–13.38%. The results align with the literature on China. For instance, Booth et al. (2022) reported that rural-urban migrants' union wage premiums in China ranged from 4.8–14.0%, whereas Mao et al. (2016) indicated 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%, 11.0%, and 27.3% for the nation, public sector, and private sector, respectively).³ Compared with the literature on China, the estimated results are similar to the results (13.2–25.7%) of Lee and Wei (2017); however, they are smaller than (approximately 38%) those of Q. 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 & Nermo, 2017). The international comparisons indicate that during the socialism era, owing to the enforcement of the Chinese government's equal employment policies, the gender wage gap was smaller (Gustafsson & Li, 2000; Ma, 2024). However,

²The union wage premium is the sum of the coefficients of the union and the interaction term of the union and female dummies.

³The gender wage gap is the sum of the coefficients of the female and the interaction terms of the union and female dummies.

with the progressive market-oriented reform, the gender wage gap in China expanded, becoming greater than that in developed countries currently.

Third, for the overall samples (the nation), 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 reasons for the results can be considered as follows: the proportion of the lowwage group among women is greater than that among men (S. Li & 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.

Fourth, the union wage premium, gender wage gap, and gender gap in the union wage premium differ between the public and private sectors (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 3 for the nation (Column 1), public sector (Column 2) and private sector (Column 3). We used seven methods (from [a] to [g]): the OLS method used in the existing studies was applied (Model [a]); Heckman two-stage method was used to address the sample selection bias (Model [b]); LV model was used to address the reverse causality issue (Model [c]); FE model (Model [d]) was utilized; sample aged 16–60 was replaced with those aged 16–50 (Model [e]); dependent variable of the hourly wage was replaced with the weekly wage (Model [f]); and mothers' and fathers' education was added to the control variables (Model [g]), considering that parents' backgrounds may affect their adult children's wage levels.

Most of the results confirmed the findings in Table 2. For instance, the results in Column 1 (the nation) indicate that in general, the union wage premium ranges from 11.7–19.2%, gender wage gap ranges from 12.7–24.5%, and gender gap in the union wage premium ranges from 7.4–12.7% points when the other factors are held consistent. The results in Columns 2 (the public sector) and 3 (the private sector) indicate that the union wage premium, gender wage gap, and gender disparity in the union wage premium in the private sector are greater than those in the public sector.⁴

5.2. Gender disparity in the probability of obtaining union membership

Table 4 presents the probability of obtaining union membership based on the RE probit regression model for the nation (Panel A), public sector (Panel B), and private sector (Panel C). Three models were used in these estimations: Model 1 (Column 1) used the female dummy and controlled for the regional fixed effects and time year fixed effects; Model 2 (Column 2) added the demographic factors such as education, years of work experience and its squared term, ethnicity (Han), urban *hukou*, marital status, health status (1=healthy, 0=otherwise), and CPC membership to Model 1; and Model 3

⁴The results based on the FE model differed from those based on the other models. Two reasons can be considered: first, some unobservable time-invariant variables that are correlated with the explanatory variables may significantly affect the wage; second, the gender dummy cannot directly be examined in the FE model, which may affect the results.

	(1) Nat	ion		(2) Public	Sector		(3) Private	Sector	
	Coef.		z	Coef.		z	Coef.		z
(a) OLS									
Union	0.065	***	3.03	0.065	**	2.50	0.085	**	2.08
Woman	-0.271	***	-18.48	-0.133	***	-5.60	-0.334	***	-18.10
Union×Woman	0.127	***	3.91	0.043		1.06	0.107	*	1.79
(b) Heckman two stage									
Union	0.061	***	2.69	0.048	*	1.76	0.096	**	2.23
Woman	-0.246	***	-10.98	-0.199	***	-5.50	-0.229	***	-7.60
Union×Woman	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
(c) LVt-1 method									
Union	0.073	***	2.60	0.123	***	3.70	0.033		0.62
Woman	-0.26	***	-12.81	-0.126	***	-3.98	-0.336	***	-12.80
Union×Woman	0.081	*	1.95	-0.008		-0.10	0.106		1.37
(d) FE model									
Union	0.047		1.48	-0.027		-0.71	0.150	**	2.46
Woman	-			-		••••	-		20
Union×Woman	-0.036		-0.76	0.007		0.12	-0.114		-1.25
Hausman test (Chi2)	145.77			91.17			94.42		
Prob>chi2	0.000			0.000			0.000		
(e) Replace with samples	s aged 16–	50 (RE)							
Union	0.033	,	1.24	-0.008		-0.27	0.114	**	2.19
Woman	-0.289	***	-16.24	-0.156	***	-5.19	-0.344	***	-16.03
Union×Woman	0.108	***	2.92	0.078	*	1.78	0.023		0.33
(f) Using monthly wage	(RE)								
Union	0.054	***	2.98	0.053	**	2.39	0.061	*	1.87
Woman	-0.311	***	-23.67	-0.226	***	-10.11	-0.347	***	-21.87
Union×Woman	0.066	***	2.61	0.041		1.35	0.051		1.09
(g) Add parental educati	on variable	es (RE)							
Union	0.043	*	1.83	0.025		0.90	0.075	*	1.69
Woman	-0.278	***	-15.45	-0.141	***	-4.77	-0.333	***	-15.26
Union X Woman	0.074	**	2.07	0.032		0.75	0.038		0.57

Table 2	Dobucthocc	tort of	tha	aandar	ann i	n union	wago	promiumo
Table 5.	Robustness	lest of	me	gender	gap i	n union	wage	premiums.

Notes: Union×Woman, interaction term of union and female worker dummy variable.Control variables including demographic factors such as education, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership, work-related factors such as occupation, industrial sector, region, and year dummy variables were used in these models; the public sector dummy variable was added for all samples in Column 1. All standard errors were adjusted as cluster-robust standard error clustering on the individual level. ***p < 0.01; **p < 0.05; *p < 0.1.

(Column 3) added the work-related factor such as occupation and industrial sector to Model 2.

First, for the nation (Panel A), the results of Models 1 and 2 indicate that the coefficients of female dummy are negative (-0.417 in Model 1; -0.157 in Model 2) and significant at the 1% level. The results of the female dummy indicate that a gender disparity remains in the likelihood of becoming a union member, even when women' individual endowments are similar to those of men. This could occur for two reasons. First, this may be caused by self-selection among women that is associated with unobservable variables, such as personality, risk aversion, competitive preference. Several studies have demonstrated a significant gender disparity in personality, risk aversion, bargaining aversion, and competitive preference (Blau & Kahn, 2017; Carter et al., 2017; Horn et al., 2022; Nordman et al., 2019). Second, this may be associated with discrimination against women who participate in unions. According to the taste-based

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Table 4. Gender	disparities in	the	probability	y of	obtaining	union	membership

	(1)			(2)			(3)	
Total	Coef.		z	Coef.		z	Coef.	z
Panel A: Nation								
Woman	-0.417	***	-7.01	-0.157	***	-2.71	-0.066	-1.07
Demographic factors	No			Yes			Yes	
Work-related factors	No			No			Yes	
Regional fixed effect	Yes			Yes			Yes	
Time year fixed effect	Yes			Yes			Yes	
No. of obs.	29,356			29,356			29,356	
No. of group	12,092			12,092			12,092	
Log likelihood	-10180.653			-8854.412			-/150.5/8	
LR test of rho = 0	/064.63			4554.3			2889.63	
$Prob \geq chibar2$	0.000			0.000			0.000	
Panel B: Public sector								
Public sector								
Woman	-0.225	**	-2.55	-0.184	**	-2.09	-0.064	-0.68
Demographic factors	No			Yes			Yes	
Work-related factors	No			No			Yes	
Regional fixed effect	Yes			Yes			Yes	
lime year fixed effect	Yes			Yes			Yes	
No. of obs.	8,512			8,512			8,512	
No. of group	3,570			3,570			3,570	
Log likelihood	-4404.838			-4017.148			-30/3.311	
LR lest of $rno = 0$	1918.58			1520.58			1324.83	
	0.000			0.000			0.000	
Panel C: Private sector								
Private sector								
Woman	-0.296	***	-4.21	-0.137	*	-1.89	-0.038	-0.43
Demographic factors	No			Yes			Yes	
Work-related factors	NO			NO			Yes	
Regional fixed effect	Yes			Yes			Yes	
Time year fixed effect	Yes			Yes			Yes	
No. of obs.	20,844			20,844			20,844	
No. of group	9,400 4000 7222			9,400 4270 407			9,400 2272 105	
Log likelihood $I R$ tost of the -0	-4077.2333			-43/9.40/			-22/2.102	
Proh > chihar?	2393.99			0.000			0.000	
	0.000			0.000			0.000	

Notes: The RE probit regression model was used. Demographic factors include years of schooling, years of work experience and squared term, health status, ethnicity, urban *hukou*, married, CPC membership; work-related factors includes occupation and industrial sector; the public sector dummy variable was added for all samples in Panel A. All standard errors were adjusted as cluster-robust standard error clustering on the individual level.

***p < 0.01; ** p < 0.05; *p < 0.1.

discrimination theory (Becker, 1957), as most union members are men (Farber et al., 2021), they may prefer male union members to female ones; consequently, the probability of becoming a union member may be higher for men than for women. The coefficient of the female dummy became insignificant in Model 3, indicating that work-related factors may considerably affect the gender disparity in unionism.

Second, for the public (Panel B) and private sectors (Panel C), the findings are similar to those for the nation. In both public and private sectors, the coefficients of female dummy were negative and statistically significant in Models 1 and 2, whereas they became insignificant in Model 3. The results suggest that gender disparity in unionism exists in both public and private sectors. Additionally, comparing the magnitudes of the coefficients of female dummy in Models 1 and 2, it changed from -0.225 to -0.184 for the public sector and from -0.296 to

-0.137 for the private sector, suggesting the influence of demographic factors on the gender disparity in unionism is greater for the private sector than for the public sector.

5.3. Decomposition results of the gender wage gap based on the O-R method

Table 5 presents the decomposition results based on the O-R method. First, the influence on the formation of the gender wage gap is greater for the return effect than for the endowment effect in both public and private sectors. The return effect widens the gender wage gap, whereas the endowment effect reduces the wage gap in both sectors, suggesting that discrimination against women may be the primary component of the gender wage gap in China.

Second, the contribution rate of the union wage premium in the return effect is -1.2% for the nation, -18.5% for the public sector, and 0.1% for the private sector, indicating that the gender disparity in union wage premium reduces the wage gap in the public sector while widening the wage gap in the private sector; as a result, it slightly reduces the nationwide gender wage gap.

The contribution rate of unions in the endowment effect is 0.7% for the nation, 1.3% for the public sector, and 0.2% for the private sector. This suggests that the gender disparity in union density widens the wage gap in both public and private sectors, and the effect in the public sector is greater than that in the private sector.

5.4. Decomposition results of the gender wage gap based on the D-R method

Although the results from the Q-R decomposition method explored the effects of the union wage premium and unionism on the gender wage gap, the endowment and return effects among union and non-union members remain unclear. Furthermore, as the

	(1) Nati	on	(2) Public S	Sector	(3) Private Sector				
	(a) Endowment	(b) Return	(c) Endowment	(d) Return	(e) Endowment	(f) Return			
Wage gap (value) Contribution rate (%)	-0.018	0.222	-0.050	0.108	-0.0002	0.2858			
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%			
Other factors	-9.3%	109.8%	-88.0%	205.2%	-0.3%	100.0%			
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%			
Industry	7.0%	6.5%	-10.9%	15.5%	10.0%	2.3%			
Public sector	0.3%	-23.4%							
Region	-2.8%	14.9%	2.6%	13.4%	-2.9%	12.4%			
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%			

Table 5. Decomposition results of gender wage gap based on the O-R method.

Notes: Oaxaca-Ransom (Oaxaca & Ransom, 1994) decomposition method was used. The results of wage functions from the RE model were used in the decomposition analysis.

Q-R decomposition method only uses the union dummy as one exogenous variable, it remains unclear how the endowment and return effects affect unionism and their effects on the gender wage gap. We used the D-R decomposition method to further explore the union effects on the gender wage gap into three channels: component A (the endowment effect of wage setting) in union members (A1) and non-union members (A2); component B (the return effect of wage setting) in union members (B1) and non-union members (B2); and component C (unionism effect) includes the endowment effect (C1) and return effect (C2). The contribution rates of these components are summarized in Table 6.

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

Second, in terms of each factor, based on the results of Column 1 (1) in component A, the contribution rate is a negative value for both union (A1) and non-union members (A2), and it is greater for non-union members (-45.0%) than for union members (-8.1%). This suggests that the gender disparity in endowments (e.g., the years of schooling are longer for women than for men, the years of work experience are longer for men than for women, see Table 1) is likely to reduce the gender wage gap, and its effect is greater for non-union members than for union members. Unlike the decomposition based on the Q-R method, which only calculated the total endowment effect, the results based on the D-R method separately explored the endowment effect by union and non-union members. The conclusions based on the total values of the endowment effect of wage setting from the two methods are consistent: the value based on the Q-R method is -8.6%, and that based on the D-R method is -53.1%, suggesting that gender disparity in individual endowments contributes to diminishing the gender wage gap in China.

(1) In terms of the B component, based on the results of Column 1, the contribution rate is a positive value for both union members (B1) and non-union members (B2), and it is greater for non-members (136.3%) than for union members (12.5%). The results suggest that the return effect (including the discrimination against women) widens the gender wage gap for both union and non-union members, and its effect is greater for non-union members than for union members. Unlike the decomposition based on the Q-R method, which only calculated

	(1) Nation		(2) Public Sector		(3) Private Sector	
	Value	%	Value	%	Value	%
Total gender wage gap	0.204	100%	0.058	100%	0.286	100%
A: Endowment effect	-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: Return effect	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: Unionism effect	0.009	4.4%	0.103	-178.1%	0.003	1.2%
C1: Endowment	0.008	3.8%	-0.005	-8.7%	0.003	1.2%
C2: Return	0.001	0.6%	-0.098	-169.4%	0.000	0.0%

Table 6. Decomposition results of gender wage gap based on the D-R method.

the total return effect, the results based on the D-R method separately explored the return effect by union and non-union members. The conclusions based on the total values of return effects of wage setting from the two methods are consistent: the values based on the Q-R method are 108.6%, and those based on the D-R method are 148.8%. This suggests that gender disparity in the return effect, including discrimination against women in the workplace, contributes to expanding the gender wage gap in China.

- (2) Regarding component C, the results for the nation (Column 1) indicated that both return (C2) and endowment effects (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 gender disparity in the return effect and the gender difference in individual endowments may generate a gender disparity in the opportunity to obtain union membership, thereby contributing to expanding the gender wage gap. The effect of the gender difference in the endowment effect is greater than that in the return effect. These results based on the D-R decomposition method are new findings of this study, which may enrich our knowledge on the mechanism of unionism and the relationship between unions and the gender wage gap.
- (3) In comparing the magnitude of the contribution rate of each factor, based on the results of Column 1, the return effect of wage setting among non-members (B2) is the greatest (136.3%). This suggests that the gender disparity in the return effect, including discrimination against women among non-members, is the main factor generating the overall gender wage gap in China. These new findings of this study are consistent with those of Mao et al. (2016).

The results may be because of the difference in compliance between implementing labor policies in the public and private sectors (Ye et al., 2015). As most female non-union members are in the private sector and the union density is lower for the private sector than for the public sector (Ma, 2024), the influence of unions on the implementation of equal employment policies in the private sector may be smaller than that in the public sector, leading to the large discrimination against women among non-union members.

Third, comparing the public sector with the private sector (Columns 2 and 3), (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 endowment effect of wage-setting reduces 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 the return effect, including the discrimination against women in the workplace, contributes to widening 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 the gender disparity in unionism reduces the gender wage gap in the public sector and widens the wage gap in the private sector.

(4) To compare the magnitude of the contribution rate of each factor, the return effect in non-union members (B2) is greatest for both public and private sectors, whereas the value is greater for the public sector (408.4%) than that for the private sector (169.6%), suggesting that the return effect in non-union members is the main factor generating the gender wage gap in both sectors, and the effect is greater for the public sector.

6. Conclusions

This study explored the effects of unions on the gender wage gap in China. This study was the first to decompose the gender wage gap into three channels (endowment effect of wage setting among union and non-union members, return effect of wage setting among union and non-union members, and unionism effect) using six waves of national longitudinal survey data from the CFPS from 2010 to 2020. Moreover, this study compared the differences in the three effects 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%. The result is consistent with the previous studies for developed countries (Farber et al., 2021; Kulkarni & Hirsch, 2021; Masso et al., 2022; Oberfichtner et al., 2020; Tober, 2022) and China (Booth et al., 2022; Gunderson et al., 2016; M. Li & Xu, 2014; Liu et al., 2018; Ma, 2024; Yao & Zhong, 2013), reconfirming a positive union wage premium in the Chinese context. The results indicated that the union wage premium is greater for women than for men. This study is the first to explore this in China, revealing that the union wage premium beneficial for women is greater for the public sector than for the private sector.

Second, a gender disparity exists in the probability of obtaining union membership when the demographic factors are held consistent. Additionally, work-related factors (e.g., occupation, industrial sector) significantly affect the gender disparity in unionism.

Third, the decomposition results based on the D-R method indicate that the return effect, which includes discrimination against women in the workplace, is greater than the endowment and unionism effects. The return effect among non-union members is the greatest among all components. Furthermore, this study revealed that the return effect among non-union members is the primary factor generating the gender wage gap for either the public or private sectors, whereas its effect is greater for the public sector than for the private sector. The gender disparity 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 may widen the overall gender wage gap in China.

Our findings have several practical implications for future research. First, the gender disparity 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. The policy of expanding union coverage among women is expected to reduce the gender wage gap.

Second, the empirical results indicated that the gender disparity in union density widened the gender wage gap in the private sector. Therefore, to reduce the gender wage

gap, the Chinese government should promote the implementation of employment equality policies in the private sector, and the specific policy of increasing women's union membership in the private sector is also expected to reduce the gender wage gap.

Finally, this study has some limitations. While we used FE/RE models, Heckman twostage method, and LV method to address some of the endogeneity issues in examining union wage premiums, 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 effects on the gender wage gap between the public and private sectors. We expect the Chinese experience to provide valuable evidence for other countries.

Disclosure statement

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Data availability statement

The dataset used in this study was obtained from the China Family Panel Studies (CFPS) and is publicly available (http://opendata.pku.edu.cn/en). The dataset and materials constructed during this study are available from the corresponding author upon request.

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Appendix

	Definitions	Mean	SD	Min	Max
Union	1=union member, 0=non-union member	0.159	0.365	0	1
Logarithm of hourly	Calculated based on wage and work hours	2.357	0.774	0.693	6.781
Education	Vears of schooling	11 086	4 072	٥	22
Experience	Vears of experience—age-6-years of schooling	22 340	11 953	0	51
Gondor	1-female workers. 0-male workers	0.406	0 /01	0	1
Ethnicity	1-Han majority, 0-ethnic minorities	0.400	0.491	0	1
Health	1-health status is very good or good 0-otherwise	0.757	0.150	0	1
llrhan	1-urban hukou 0-rural hukou	0.427	0.495	0	1
Married	1-having a spouse 0-otherwise	0.705	0.416	0	1
CPC membershin	1 – CPC member 0–pop-CPC member	0.778	0.410	0	1
Occupation	r= er e member, o=non er e member	0.100	0.572	U	
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	1=other occupation, 0=otherwise	0.263	0.440	0	1
Industry sector		1.000			
Manufacture	1=manufactural industry sector, 0=otherwise	0.343	0.475	0	1
Traffic and	1=traffic and information industry sector, 0=otherwise	0.080	0.271	0	1
information					
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	1=other industry 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					
2010	1=2010 survey year, 0=otherwise	0.161	0.367	0	1
2012	1=2012 survey year, 0=otherwise	0.169	0.375	0	1
2014	1=2014 survey year, 0=otherwise	0.178	0.382	0	1
2016	1=2016 survey year, 0=otherwise	0.176	0.381	0	1
2018	1=2018 survey year, 0=otherwise	0.179	0.383	0	1
2020	1=2020 survey year, 0=otherwise	0.137	0.344	0	1
Observations	14,619				

Table A1. Definition and de	scriptive statistics	of variables	(total sam	ples).
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