Economics Bulletin

Volume 43, Issue 2

Trade union and gender wage gap: Evidence from China

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Abstract

This study is the first to explore the effects of trade unions on the gender wage gap in China. It uses the national longitudinal survey data of 2014–2020 to address endogeneity issues. The results demonstrate that the union wage premiums are higher for women than for men, while the probability of obtaining a union membership are lesser for women than for men. The decomposition results indicate that discrimination against women in non-union member groups is the primary factor contributing to the gender wage gap; further, the discrimination in obtaining union membership also widens the wage gap in China.

Contact: Xinxin Ma:xxma@hosei.ac.jp. I acknowledge Professor John P. Conley and Professor Thomas Ahn for their helpful comments and suggestions.
Citation: Xinxin Ma, (2023) "Trade union and gender wage gap: Evidence from China", *Economics Bulletin*, Volume 43, Issue 2, pages 1098-1110
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Submitted: December 23, 2022. **Published:** June 30, 2023.

1. Introduction

Trade unions exist in developed and developing countries (Lewis 1963; Freeman 1980; Card 1996; Casale and Posel 2010; Yao and Zhong 2013; Gunderson *et al*. 2016; Farber *et al.* 2021; Kerr and Wittenberg 2021; Kulkarni and Hirsch 2021; Masso *et al.* 2022). As trade unions can protect their union members through collective bargaining, they are expected to increase the wage levels of the disadvantaged union members (e.g., female workers), which may in turn affect the wage gap. Although many countries have aimed to reduce the discrimination against women in the workplace, the gender wage gap persists worldwide (Biewen *et al.* 2020; Ge and Zhou 2020; Iwasaki and Ma 2020; Masso *et al.* 2022). This study explores the influence that trade unions have on the gender wage gap.

With regards to the association between trade unions and the gender wage gap, three channels can be considered as follows: first, when a trade union increases the wage levels of its female union members (most of whom are low-wage workers), it may reduce the gender wage gap among union members. However, according to the employers' discrimination hypothesis (Becker 1957), when discrimination against non-union female workers does exist, the influence of the trade union on the overall gender wage gap may become unclear. Second, based on the human capital theory (Becker 1964), when male workers' human capital (e.g., education attainment) is more than that of female workers, a gender wage gap may arise. Third, a gender gap in unionism (e.g., trade union density rate) may affect the gender wage gap (Even and Macpherson 1993). Therefore, from an economic theory perspective, the influence of trade unions on the gender wage gap is unclear, necessitating an empirical study.

Do trade unions affect the gender wage gap, and if so, how? This study attempts to provide evidence on the issue from China, which is a developing and emerging economy country with the highest number of male and female workers in the world.

Although Card (1996), Farber *et al.* (2021), and Tober (2022) have explored that the trade union may affect income inequality or the wage gap, empirical studies on the influence of trade unions on the gender wage gap are scarce. While a few

studies have focused on the issue, they have largely been conducted in developed countries (Even and Macpherson 1993; Dorion and Riddel1994; Aidt and Tzannatos 2002). In China, Li and Xu (2014), Gunderson *et al.* (2016), and Yu et al. (2020) have revealed the union wage premium, and Mao et al. (2016) have found that discrimination against non-union female workers is a primary factor for the formation of the gender wage gap.

This study contributes to the literature in four ways. First, using an extension of the Blinder-Oaxaca decomposition model (Duguet and Petit 2007) and national longitudinal survey data, this study is the first to explore the effects of gender difference in human capital, and discrimination against women on gender wage gap in China considering the unionism. Second, this study is also the first to explore the gender gap with regards to the chance of obtaining union membership in China. Third, this study uses a model with the lagged term of union variable (LV model) and a random effects (RE) model to address the problems of reverse causality and individual heterogeneity. Thus, robust results can be obtained on these issues. Finally, this study uses the latest survey data to analyze the issue over a more contemporary period (from 2014 to 2020). Therefore, it can provide new evidence for the issue.

2. Methodology

2.1 Models

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

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

In Eq. (1), the subscript i is an indicator of the individual; U is a union membership dummy variable; F is a female dummy variable; UF is an interaction term of the union and female dummy variables; H represents the other factors (e.g., education, occupation) that may affect wage levels; β indicates the coefficients of each factor; β_{UF} denotes the gender gap in the union wage premium when all other factors are held consistent; a is a constant; u is an error term.

The Heckman two-stage method (Heckman 1979) is used to address any sample selection bias that may be caused by the working selection. One of the relevant endogeneity issues is reverse causality. The lagged term of the union membership dummy variable is used to address this issue. The other potential concern is that of individual heterogeneity; u_{it} in Eq. (1) includes the individual-specific and time-invariant factors (v_i), and the idiosyncratic error (ε_{it}). The RE model[1] is used to address this problem and is expressed in Eq. (2):

$$lnW_{it} = a + \beta_U U_{it} + \beta_F F_{it} + \beta_{UF} UF_{it} + \beta_{nH} \sum_1^n H_{it} + v_i + \varepsilon_{it}, \quad (2)$$

Second, the RE probit model is used to examine the determinants of obtaining union membership, as

$$\Pr(y^* = 1) = \Phi(b + \gamma_F F_{it} + \gamma_M M_{it} + \sigma_i + u_{it} > 0). \quad (3)$$

In Eq. (3), subscript i is an indicator of the individual; F is a female dummy variable; M represents the other factors that may affect unionism; γ indicates the coefficients of each factor; b is a constant term; σ_i denotes individual-specific factors; u_{it} is an idiosyncratic error term; and γ_F represents the gender gap in the chance of obtaining union membership when the other factors (M) are held constant.

Finally, a decomposition method (Duguet and Petit, 2007) is used to explore the components for the wage gap into three parts: (1) Component A $[p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu}]$ represents the gender gap in wage setting due to the explained components (e.g., education, years of work experience, occupation distribution); (2) Component B $[p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu})]$ is the gender gap in wage setting due to the unexplained components, including differences in the coefficients of variables (return to education, seniority wage system, etc.), and unobservable factors (e.g., personality,

[1] When the FE model is used, the number of samples reduces and the time-invariant factors (e.g., years of education, ethnicity, gender) that are important to the generation of the gender wage gap are dropped from the estimations. Therefore, this study only reports the results of the RE model and uses them in the decomposition analyses. The results of the FE model are available upon request.

unobservable ability, work effort). The component B is related to the wage setting institutions and is usually an indicator of discrimination against female workers in the workplace (Oaxaca1973; Blinder1973); (3) Component C [$(p_{mu} - p_{fu}^{*})(\overline{lnW}_{mu} - \overline{lnW}_{mnu} + (p_{fu}^{*} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu})]$ denotes the gender gap in unionism. The decomposition method is expressed by Eq. (4).

$$\begin{aligned}
&\overline{lnW}_{m} - \overline{lnW}_{f} \\
&= p_{fu}(\bar{X}_{mu} - \bar{X}_{fu})\beta_{mu} + (1 - p_{fu})(\bar{X}_{mnu} - \bar{X}_{fn})\beta_{mnu} \\
&\quad + p_{fu}\bar{X}_{mu}(\beta_{mu} - \beta_{fu}) + (1 - p_{fu})\bar{X}_{mn}(\beta_{mnu} - \beta_{fnu}) \\
&\quad + (p_{mu} - p_{fu}^{*})(\overline{lnW}_{mu} - \overline{lnW}_{mnu}) + (p_{fu}^{*} - p_{fu})(\overline{lnW}_{mu} - \overline{lnW}_{mnu}), \qquad (4)
\end{aligned}$$

where the subscript u signifies union members; nu represents non-union members; p_{fu} is the proportion of union members among the women group; β_{mu} and β_{fu} are obtained from the male and female union members' wage functions, respectively; β_{mun} and β_{fun} are obtained from the male and female non-union members' wage functions, respectively.

2.2 Data and variable setting

This study uses longitudinal data from the China Family Panel Studies (CFPS), which is a national longitudinal survey project conducted by the Peking University since 2010. The last four waves—2014, 2016, 2018, and 2020 (hereinafter CFPS of 2014–2020)—include the information (wage, union membership, etc.) that are used in the analyses. The baseline national survey was officially launched in 25 provinces, municipalities, and autonomous regions, wherein 14,960 households were interviewed successfully. Within these households, 33,600 adults and 8,990 youths were interviewed during the first wave.

This study uses data from the CFPS for several reasons. First, they include union membership status, wages, individual attributes (e.g., education, age, gender), and work information (e.g., occupation, industrial sector, public or private sector), which can be used in the empirical study. Second, the CFPS consists of longitudinal data, which can be used to partially address any endogeneity issues (individual heterogeneity, reverse casuality, etc.) and thus, provide robust empirical evidence.

The CFPS sample sizes of each wave are 37,147 (2014), 36,892 (2016), 37,354 (2018), and 28,590 (2020). The samples used in this study focus on non-agricultural workers. As the *Labor Law of the People's Republic of China* states that the minimum working age in China is 16 years, and the oldest mandatory retirement age in the public sector is 60 years,[2] only those samples aged 16–60 are selected; samples with missing values are not included.

The key dependent variable is the logarithm of the hourly wage. The information on annual wages and weekly work hours is obtained 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?," respectively. Based on the questionnaire items in the CFPS, wages are considered to comprise of basic wages, bonuses, pecuniary fringe benefits, and allowances, while excluding social insurance contributions. The hourly wages are calculated based on the annual wages and work hours. To address the effect of inflation, the annual Consumer Price Index (CPI) published by the National Bureau of Statistics of China is used to adjust the wage levels; the CPI in 2014 is used as a standard.

Referring to previous studies, the level of education, years of work experience and its square, ethnicity (Han majority), health status (healthy), urban household registration (urban *hukou*), marital status (married), Communist Party of China (CPC) membership, occupation (manager/technician), industrial sector (manufacturing industry), ownership (public sector), region (east, central, west regions), and year dummy variables are constructed as control variables.

Table 1 summarizes the descriptive statistics of the variables categorized by union and non-union groups, and by gender. The gender gap is calculated via the mean values of these variables and after employing a *t*-test. First, the average wage level in the union group is found to be higher than that in the non-union group for both men and women, suggesting that there may remain a positive union wage premium in China. Second, there is a gender wage gap in both the union and the

[2] 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. I also used samples of workers aged 16–50 years to check robustness, and the results are approximately similar to those reported in this study. These results are available upon request.

non-union groups, and the raw gender wage gap in the union group is smaller than that in the non-union group, thus indicating that the union may contribute to reducing the gender wage gap. However, it should be noted that these results do not control for other factors (e.g., education, occupation). Lastly, the results of the *t*-tests indicate that the gender gaps in the mean values of the variables are significant in both the union and non-union groups; hence, these variables should be controlled in the estimations.

Table 1 Descriptive Statistics of Variables

	(1) Union				(2) Non-union			
	Men	Women	G1=M-F	*t*-test	Men	Women	G2=M-F	*t*-test
Lnwage	3.034	2.988	0.046	***	2.421	2.084	0.337	***
Education	12.350	12.837	-0.487	***	9.139	8.102	1.037	***
Experience	28.008	24.624	3.385	***	30.350	30.965	-0.615	***
Han ethnicity	0.928	0.931	-0.003		0.946	0.940	0.006	**
Health	0.316	0.264	0.052	**	0.469	0.431	0.039	***
Urban	0.746	0.792	-0.046	**	0.406	0.399	0.007	***
Married	0.848	0.894	-0.046		0.843	0.902	-0.059	***
Party	0.047	0.051	-0.004	***	0.059	0.025	0.034	***
Manager/technician	0.194	0.365	-0.171	***	0.072	0.099	-0.027	***
Manufacturing	0.311	0.281	0.030	***	0.160	0.154	0.005	**
Public sector	0.602	0.612	-0.011	**	0.125	0.097	0.027	***
East	0.516	0.530	-0.014		0.410	0.411	0.000	
Central	0.280	0.282	-0.003		0.297	0.295	0.002	***
West	0.204	0.188	0.016	*	0.293	0.295	-0.002	***
Obs.	919	567	1486		7441	5876	13317	

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

Source: Calculated based on the data from CFPS of 2014–2020.

3. Results

3.1 Gender Gap in Union Wage Premium

The results of the wage function are presented in Table 2. Models 1–4 are distinguished based on the different models used. An interaction term of the union and female dummy variables is added in Column 2 to investigate the gender gap in union wage premiums. The results of Models 1–4 are different, suggesting that endogeneity issues do affect the estimations. The following findings are confirmed.

Table 2 Gender Gap in Union Wage Premium in China

	(1)			(2)		
	Coef.		z	Coef.		z
(1) Model1: OLS						
Union	0.098	***	3.97	0.066	**	2.15
Female	-0.229	***	-10.96	-0.250	***	-10.4
Union×Female				0.078	*	1.76
(2) Model2: Heckman						
Union	0.085	***	3.31	0.048		1.48
Female	-0.230	***	-7.24	-0.260	***	-7.34
Union×Female				0.089	*	1.92
Correction term	0.134	***	3.32	0.254	**	2.61
(3) Model4: LVt-1						
Union	0.095	***	3.78	0.059	*	1.84
Female	-0.234	***	-11.12	-0.254	***	-10.6
Union×Female				0.088	*	1.95
(4) Model5: RE						
Union	0.073	***	2.84	0.048		1.52
Female	-0.232	***	-9.72	-0.246	***	-9.49
Union×Female				0.059	*	1.95

Notes: *** $p<0.01$; ** $p<0.05$; * $p<0.10$; Union × Female is the interaction term of union and female dummies. Covariates including years of schooling, years of work experience and the squared, ethnicity, CPC membership, health status, urban *hukou*, occupation, industrial sector, region, and year dummies are controlled in the models. 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.

First, the results show that in China, there exists a union wage premium ranging from 7.3 to 9.8% (Column 1). This is consistent with the literature for China (Li and Xu 2014; Gunderson *et al.* 2016). The premium is also consistent with that given in the literature for developed countries. For example, Lewis (1990) report that the union wage premium in the US ranges from 10.0 to 25.0%; Blanchflower and Bryson (2010) point out that the union wage premium in the UK ranges from 8.26 to 13.38%.

Second, there remains a gender wage gap ranging from 22.9 to 23.4% (Column 1). The gap is in the range reported in the literature for China: while it is greater than the result (13.2–25.7%) of Lee and Wei (2017), it is smaller than that

(approximately 38%) of Guo *et al.* (2021). However, the gap is greater than that for developed countries. For example, it 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 results indicate that the gender wage gap in China was smaller in the planned economy period due to the the Chinese government‘s enforcement of employment equality policies (Ma 2021). The gender wage gap has widened in China with the progressive adoption of market-oriented reforms and has become larger than that of the developed countries in the 2000s.

Third, the union wage premium is greater for women than for men (Column 2), which is consistent with the findings of Mao *et al.* (2016). The results may be caused by the fact that the trade union has a greater effect on wages for the low-wage group than the high-wage group (Card 1996). As the proportion of the low-wage group is greater among women (Li and Ma 2015), the union wage premium is consequently greater for women than for men.

Lastly, on controlling for all observable characteristics (including education, year of work experience, occupation, industry, etc.), the wage gap between union male workers and non-union female workers ranges between 10.7% and 14.7% in China (Column 2), which is similar to for the ranges in the developed countries. For example, Duguet and Petit (2007) report that in France the wage gap between the two groups is 15.4%.

3.2 Gender Gap in the Probability of Obtaining Union Membership

Table 3 presents the results of the RE model for the probabilities of obtaining union membership. In Column 1, the individual attribute factors, region, and year dummies are used as control variables; in Column 2, the work-related variables including CPC membership, occupation (manager and technician), manufacturing industry, and public sector dummies are added.

The results indicate that the coefficient of the female dummy variable is negative (-0.237 in Column 1, -0.110 in Column 2) and significant at the 1% or 10 % level. This suggests that the likelihood of obtaining union membership is lower for women than men when other factors are held constant. This may be

caused by discrimination against female workers in obtaining union membership.

Table 3 Gender Gap in Probability of Obtaining Union Membership in China

	(1)			(2)		
	Coef.		z	Coef.		z
Female	-0.237	***	-4.31	-0.110	*	-1.92
Individual attribute factor	Yes			Yes		
Work-related factor	No			Yes		
Region	Yes			Yes		
Year	Yes			Yes		
No. of sample	14,803			14,803		
No. of group	7,846			7,846		
Log likelihood	-4398.9			-3276.6		
Prob>chi2	*p*=0.000			*p*=0.000		

Notes: *** p<0.01; ** p<0.05; * p<0.10. The RE probit model was used in this study. Individual attribute factors (year of schooling, year of work experience and its square, and ethnicity), work-related factors (CPC membership, health status, urban hukou, occupation, industrial sector), region, and year dummies are controlled in the models. The results are not expressed in the table and are 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.

3.3 Decomposition Results of Trade Union Effect on Gender Wage Gap

The decomposition results based on the Duguet-Petit method are presented in Table 4. Regarding the three main components (A, B, and C), the contribution rate of Component A is negative (-19.4%), while those of Components B and C are positive (114.5% for B, 4.9% for C). The results indicate that the unexplained components in wage settings (B) and unionism (C) may widen the gender wage gap, while the explained component in wage settings (A) may reduce the wage gap. This suggests that discrimination against female workers in wage setting and obtaining union membership generates the gender wage gap, and that the effect of this discrimination in wage setting is the greatest of the three components.

Further, the following observations are made in terms of each factor:

(1) In Component A, while the contribution rate is negative for both the union (A1) and non-union (A2) groups, it is greater in magnitude for the non-union group (-15.7%) than the union counterpart (-3.7%). This suggests that the gender gap in

endowment (e.g., the years of schooling are more for women than men in the union member group, the years of work experience are more for women than men in the non-union group, see Table 1) reduces the gender wage gap in both groups, and that its effect is greater on the non-union group.

(2) In Component B, the contribution rate is positive for both union (B1) and non-union (B2) groups, and is greater for the non-union group (111.7%) than its union counterpart (2.8%). This suggests that while discrimination against female workers widens the gender wage gap in both groups, the effect is greater in the non-union group.

(3) In Component C, the unexplained component (C2) has a positive value (5.5%), while the explained component (C1) has a small negative value (-0.6%). These results suggest that discrimination against female workers in obtaining union membership widens the gender wage gap.

(4) Comparing the contribution rate of each factor, the unexplained component in the non-union group (B1) is the greatest (111.7%), suggesting that discrimination against female workers among the non-union group is the primary factor contributing to the gender wage gap in China.

Table 4 Decomposition Results of Gender Wage Gap in China

	Value	Contribute rate
Total gender wage gap	0.325	100%
A: Explained component	-0.063	-19.4%
A1: Union member group	-0.012	-3.7%
A2: Non-union member group	-0.051	-15.7%
B: Unexplained component	0.372	114.5%
B1: Union member group	0.009	2.8%
B2: Non-union member group	0.363	111.7%
C: Obtaining union membership	0.016	4.9%
C1: Explained component	-0.002	-0.6%
C2: Unexplained component	0.018	5.5%

Notes: The Duguest-Petit decomposition method is used. The decomposition was based on the RE model.

Source: Calculated based on the data from CFPS of 2014–2020.

4. Conclusions

This study is the first to explore the influence of trade unions on the gender wage

gap in China. It addresses the endogeneity issues by using national longitudinal survey data from the CFPS of 2014–2020.

The study draws the following three conclusions. First, a union wage premium exists, which ranges from 7.3 to 9.8%; this is higher for women than for men. Second, women have a lower probability of obtaining union membership relative to men. Third, the decomposition results indicate that discrimination against female workers in the setting of wages among the non-union group is the primary factor for the existence of a gender wage gap; further, discrimination against female workers in obtaining union membership also widens this wage gap. The Chinese government should enforce the implementation of employment equality policies as well as expand union coverage among the disadvantaged groups (e.g., female workers) to reduce the wage gap.

Conflict of interests

The authors declare no conflicts of interest associated with this study.

Data availability statement

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

Funding

This work was supported by the Japan Society for the Promotion of Science [Grant number: 20H01512].

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