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Parenthood and the gender wage gap in urban China

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ABSTRACT

Using data from the Chinese Household Income Project survey and decomposition methods, this study explored the influence of parenthood on the gender wage gap in urban China in 2002 and 2018. Our findings showed that the employment rate is lower for women than men in both childless and with child groups, and the gender gap expanded from 2002 to 2018. The data revealed a parenthood wage penalty in 2002 and a parenthood wage premium in 2018. Moreover, the parenthood wage penalty was greater for women than for men and contributed to the formation of the gender wage gap. We also found that three components: motherhood wage penalty, fatherhood wage premium, and gender wage gap in the childless group contributed to the formation of the gender wage gap. From 2002–2018, the motherhood wage penalty decreased, whereas the fatherhood wage premium increased.

1. Introduction

In China, the expansion of income inequality amid market-oriented reform has become a serious social problem (Li, Sato, & Sicular, 2013; Sicular, Li, Yue, & Sato, 2020). The study of wage gaps is of great significance to addressing income inequality because wages comprise the largest share of the income of urban residents. Currently, among the variety of wage gaps in China, the gender wage gap has become significant and merits investigation.

The present study focused on parenthood[1] and the gender wage gap in urban China. The widening gender wage gap contributes to the expansion of income inequality. Since the 1980s, the gender wage gap has expanded along with market-oriented reforms (Gustafsson & Li, 2000; Li, Song, & Liu, 2011; Ma, 2018).[2] Addressing the problem of income inequality in China requires empirical research on the determinants of the gender wage gap.

With the reform of state-owned enterprises (SOEs) and development of privately-owned enterprises (POEs) and foreign-owned enterprises (FOEs), women workers may face worse discrimination in the workplace compared with mean during the planned economy period, when the Chinese government enforced employment and wage equality policies in the public sector. This negative impact may be exacerbated by the Chinese government's deregulation of the one-child policy in the 2000s, owing to the segregation of gender roles under the influence of Confucianism, which sees the husband as the breadwinner and the wife as the homemaker or caregiver. Thus, the work–family life conflict of Chinese women can be presumed to escalate. The influence of family responsibility on the gender wage gap in China therefore needs to be studies.

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[1] Parenthood refers to the group with one or more children; family gap indicates the differences between the group with and without children (e.g., Gangl & Ziefle, 2009; Angelov, Johansson, & Lindahl, 2016; Cukrowska-Torzewska & Lovasz, 2016, 2020).

[2] Based on data from the third Chinese Female Social Status Survey (CFSSS) conducted by the National Female Federation, the gender wage gap (the ratio of women's wages to men's wages) in urban China increased from 77.5% (1990) to 63.7% (2010).

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Empirical studies in developed countries have found that the influence of the family gap (e.g., number of children) on wages differs by gender, which may positively affect married men's wages (the fatherhood wage premium) but negatively affect married women's wages (the motherhood wage penalty). This indicates that the family gap is an important factor of the gender wage gap (Angelov et al., 2016; Bütikofera, Jensen, & Salvanes, 2018; Cukrowska-Torzewska & Lovasz, 2020; Dolton & Makepeace, 1986; Waldfogel, 1998). In the case of China, numerous empirical studies have investigated the determinants of the gender wage gap, including the endowment of human capital (e.g., education, years of work experience) and discrimination against women workers (Meng, 1998; Gustaffson & LI, 2000; Liu, Meng, & Zhang, 2000; Li et al., 2011; Ma, Gu, & Li, 2013), occupational segregation (Li & Ma, 2006; Meng & Miller, 1995; Wang, 2005a), segmentation by industry or ownership sectors (Ge, 2007; Ma, 2018; Wang & Cai, 2008; Wang, 2005b), and labor policies, such as the minimum wage (Li & Ma, 2020). Meanwhile, research on the influence of parenthood on the gender wage gap is limited.

Using data from two periods of the Chinese Household Income Project survey conducted in 2003 and 2019 (CHIPs2002, CHIPs2018) and decomposition methods, this study investigated the influence of the family gap on the gender wage gap in China. To the best of my knowledge, this study is the first to focus on the issue of parenthood and the gender wage gap using decomposition methods. The results can provide new evidence and insights. Moreover, the use of the latest survey data (i.e., CHIPs2018) enabled us to elucidate the association between parenthood and the gender wage gap in the current period. Lastly, I performed an empirical study for two time points–2002 and 2018—to compare the change in the influence of parenthood on the gender wage gap in the context of the market-oriented reform and deregulation of the one-child policy.

2. Literature review

2.1. General economic theories on the gender wage gap in urban China

Among the economic theories that explain the gender wage gap in urban China are the employer discrimination hypothesis (Becker, 1957) and statistics discrimination hypothesis[3] (Arrow, 1972, 1973; Phelps, 1972): discrimination against women by employers, customers, and colleagues causes the gender wage gap. In China, where the influence of Confucianism is strong and gender role division in the family is common, a female worker is assumed to have more family responsibilities than a male worker. Therefore, even when the labor productivity of women workers is the same as that of their male counterparts, when the employer presumes that the work effort and probability of long-term work are higher for men whereas women carry more family responsibility, the employer may set the wage level of women workers lower than that of their male counterparts.

Based on human capital theory (Becker, 1964; Mincer, 1974), in a perfectly competitive labor market, the individual wage level is determined by workers' labor productivity. Labor productivity is related to a worker's human capital (e.g., education, years of experience). When the educational attainment level is higher for men than for women, a gender wage gap may appear. In addition, mothers may lose out on skills development during care-related career breaks (e.g., Gangl & Ziefle, 2009; Napari, 2010; Abendroth, Huffman, & Treas, 2014), which may reduce their wage level when they return to the labor market. This phenomenon is called the "motherhood wage penalty" (Cukrowska-Torzewska and Lovasz, 2020, 2016).

The labor market segmentation hypotheses may also explain the existence of gender wage gaps. Piore (1970) suggested that the labor market is not a perfectly competitive market but rather is segmented by the primary market, in which the wage level is higher, and the secondary market, in which the wage level is lower. Thus, the gender wage gap exists when men dominate the primary market (e.g., regular work), and women do the secondary market (e.g., non-regular work).

Lastly, the gender wage gap may be a result of self-selection. For example, regarding family responsibilities, married women are likely to select jobs with flexible working hours, such as part-time jobs, in which the wage level is lower. Therefore, an occupation or position in an industry sector in the current period may be the result of a woman selecting it in the past after considering family responsibilities (Anderson, Binder, & Krause, 2003; Felfe, 2012; Korenman & Neumark, 1992).

2.2. Empirical studies on the family gap and gender wage gap

There is considerable literature on family and wage gaps. Whereas women are generally found to be penalized for motherhood in the form of lower wages (Davies & Gaëlle, 2005; Gangl & Ziefle, 2009; Gupta & Smith, 2002; Nielsen, Simonsen, & Verner, 2004; Simonsen & Skipper, 2006; Waldfogel, 1998), fathers tend to receive a wage premium (Lundberg & Rose, 2000; Waldfogel, 1998). The magnitudes of these gaps vary depending on how the gap is being estimated, and on the covariates included in specifications, wage measure used, and definition of parenthood (Cukrowska-Torzewska and Lovasz, 2020, 2016). For example, the disadvantage of motherhood on the gender wage gap is largest when annual earnings are considered, but it decreases when monthly wages are used, and decreases even further based on hourly wages. This range is due to the adjustment in hours worked following the child status: fathers tend to increase their working time, whereas mothers tend to decrease it and often remain in part-time employment in the long

[3] The statistics discrimination hypothesis suggests that because the employer cannot have absolute information on their employees, the employer has to make the decision on employment or wage for men and women workers based on the average values of some factors that are not observed in the present (e.g., work effort, probability of turnover). When the employer presumes that the probability of housework (e.g., family care, home cleaning, cooking) is higher for the women than for the men, the same employer may reduce the hours worked or set a lower wage level for the women. This presumption on the part of the employer may cause the women to put in less work effort and report a higher turnover rate.

run. This point is crucial when considered with the increased specialization of couples in the labor market and household activities (e.g., Lundberg & Rose, 2000; Angelov et al., 2016). For the parenthood or family gap in China, Zhang (2011) and Ma & Zhang, 2019 found that the number of children negatively affects mothers' labor force participation. Wage levels decrease as the number of children increases (Yu & Xie, 2014; Zhang, 2011). However, these studies did not explore the association between parenthood and the gender wage gap.

Empirical studies on the gender wage gap in urban China (Gustaffson & LI, 2000; Liu et al., 2000; Li et al., 2011; Ma et al., 2013; Ma, 2018, 2021) have used the Blinder–Oaxaca (Blinder, 1973; Oaxaca, 1973), Oaxaca and Ransom (1994), or Melly (2006) models to conduct decomposition analysis. Both the explained (e.g., endowment of human capital) and unexplained components (e.g., discrimination against women) affect the gender wage gap. Comparisons of the influences between these two components in most studies have shown that the influence of the unexplained components is greater than that of the explained ones. Thus, discrimination against women is the main reason for the gender wage gap in urban China.

Meanwhile, many studies have examined the effect of segmentation by sector on the gender wage gap in urban China[5]. Wang (2005a) and Li and Ma (2006) analyzed the influence of occupational segregation on the gender wage gap. Segmentation by industry type (Ge, 2007; Ma, 2018; Wang & Cai, 2008; Wang, 2005b) and ownership sector (Demurger, Fournier, Li, & Wei, 2007; Guo & Zhang, 2010; Liu et al., 2000; Maurer-Fazio & Hughes, 2002) likewise contribute to the formation of the gender wage gap.

Our study investigated the following three questions to fill the gap in literature on parenthood and the gender wage gap in urban China: first, how do the differences in the endowment of parenthood affect the gender wage gap? Second, how is the gender wage gap affected by discrimination against women? How does parenthood contribute to the discrimination component? Third, how do family gaps among men (fatherhood wage premium) and women (motherhood wage penalty), and the gender wage gap within the non-parenthood group (childless group) affect the gender wage gap? We believe that our study is the first one to investigate the influence of parenthood on the gender wage gap in 2002 and 2018 in urban China.

3. Methodology and data

3.1. Model

We used the ordinary least squares (OLS) model to express the wage function as Eq. (1) [6]:

$$LnW_i = a + \beta_c C_i + \beta_H H_i + u_i \tag{1}$$

Considering the sample selection bias problem (i.e., an individual can choose to work or not) found in the OLS model, we used the Heckman two-step model (Heckman, 1979). Based on the estimated results of the distribution and density functions in the probit regression model (in which the dependent variable $\Pr(Y_i = 1)$ is the probability of the choice to work), we calculated the selection bias correction item ($\lambda = \phi(.)/\Phi(.)$). The probit regression model included the identification variables. The corrected wage functions are expressed by Eqs. (2) and (3).

$$LnW_i = a + \beta_c C_i + \beta_H H_i + \beta_\lambda \lambda_i + u_i \tag{2}$$

$$LnW_{ij} = a_j + \beta_{cj} C_{ij} + \beta_{Hj} H_{ij} + \beta_{\lambda j} \lambda_{ij} + u_{ij} \quad \left(j = males, \quad females\right) \tag{3}$$

In Eqs. (1), (2) and (3), i represents the individual and j represents the man or woman worker. LnW is the logarithm value of hourly wage, C indicates parenthood (e.g., number of children), H represents the factors that affect wages (e.g., years of schooling, years of work experience), and u is a random error item. The results from Eq. (2) indicate the overall influence of parenthood on wages for the total sample. Those of Eq. (3) show the parenthood effect for the male and female groups, respectively.

Next, we used the Blinder–Oaxaca decomposition model to estimate the determinants of the gender wage gap. Based on Blinder (1973) and Oaxaca (1973), we expressed the Blinder–Oaxaca decomposition model as follows[4]:.

$$\overline{LnW_m} - \overline{LnW_f} = \beta_{\mathrm{m}}\left(\overline{X}_m - \overline{X}_f\right) + \left(\beta_{\mathrm{m}} - \beta_{\mathrm{f}}\right)\overline{X}_f \tag{4}$$

$$\overline{LnW_m} - \overline{LnW_f} = \beta_{\mathrm{f}}\left(\overline{X}_f - \overline{X}_m\right) + \left(\beta_{\mathrm{f}} - \beta_{\mathrm{m}}\right)\overline{X}_m \tag{5}$$

where $\overline{LnW_m} - \overline{LnW_f}$ expresses the gender wage gap; m and f are the male and female groups, $\overline{X}_m$ and $\overline{X}_f$ are the mean values of the variables of the male and female groups, β_{m} and β_{f} are estimated coefficients, respectively.[5] Based on human capital theory (Becker, 1964; Mincer, 1974) and the discrimination hypothesis (Becker, 1957), the decomposition model decomposes the gender wage gap into two parts: the explained $[\beta_{\mathrm{m}}(\overline{X}_m - \overline{X}_f)$ or $\beta_{\mathrm{f}}(\overline{X}_f - \overline{X}_m)]$ and unexplained components $[(\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\overline{X}_f$ or $(\beta_{\mathrm{f}} - \beta_{\mathrm{m}})\overline{X}_m]$. The explained component expresses the differentials of individual attributes, such as differences in human capital endowments and

[4] All constant items were omitted to simplify the expression of equations.

[5] Although Reimers (1983), Cotton (1988), Neumark (1988), Oaxaca and Ransom (1994), Fortin (2008) argued the "index number" problem in the basic Blinder–Oaxaca model, these studies have used classifications of the unexplained and explained components that are similar with the Blinder–Oaxaca model. Estimated results may vary with the kind of comparison group used. Given space constraints and because the two sets of decomposition results are almost identical, only the estimated results using equation 2.1 are presented in the current work.

parenthood situation (e.g., having or not having a child, differences in the number of children). The unexplained component includes the differences in wage determination systems (e.g., differences in return to education and years of experience), discrimination against women workers with children (working mother group), and capabilities not measurable at present. The larger the estimated unexplained component, the greater is the influence of discrimination against women workers.

We also used the decomposition model of Cukrowska-Torzewska and Lovasz (2016) to investigate the gender wage gap from three points: (i) wage gap between mothers and childless women (the family gap within the women group); (ii) wage gap between fathers and childless men (the family gap within the men group); (iii) wage gap among childless groups, which could directly estimate for the existence of a fatherhood wage premium or motherhood wage penalty. The decomposition model is expressed as follows:

$$\overline{LnW_m} = p_m\overline{LnW_m^C} + (1-p_m)\overline{LnW_m^{NC}} \tag{6}$$

$$\overline{LnW_f} = p_f\overline{LnW_f^C} + \left(1-p_{\mathrm{f}}\right)\overline{LnW_f^{NC}} \tag{7}$$

where C and NC express the group with children and the childless group, respectively. p_{m} and p_{f} are the shares of the men and women who have children. Eqs. (6) and (7) are the wage functions of men and women, respectively. The gender wage gap is decomposed as follows:

$$\overline{LnW_m} - \overline{LnW_f} = p_{\mathrm{m}}\left(\overline{LnW_m^C} - \overline{LnW_m^{NC}}\right) - p_{\mathrm{f}}\left(\overline{LnW_f^C} - \overline{LnW_f^{NC}}\right) + \left(\overline{LnW_m^{NC}} - \overline{LnW_f^{NC}}\right) \tag{8}$$

In this decomposition model, when the first component ($p_{\mathrm{m}}(\overline{LnW_m^C} - \overline{LnW_m^{NC}})$) is a positive value, then men receive a wage premium associated with fatherhood, and this premium drives men's average wages to rise, which contributes to expanding the gender wage gap (fatherhood wage premium). When the second component ($p_{\mathrm{f}}(\overline{LnW_f^C} - \overline{LnW_f^{NC}})$) is negative, it indicates that women are penalized for motherhood, which contributes to the formation of a gender wage gap (motherhood wage penalty). When the third component is a positive value, then a gender gap favoring men among the childless group also increases the overall gender wage gap. Each of the three components is then additionally decomposed into two parts: explained (endowment) and unexplained (discrimination) components, as in the standard Blinder–Oaxaca decomposition.

Regarding the sample selection bias in the results of the Blinder–Oaxaca model based on the OLS wage function, we also used the model by Oaxaca and Choe (2016) to conduct a robustness check. This model includes the selection bias correction item in decompositions, shown in Eqs. (9) and (10). The explained component included $[\beta_{\mathrm{m}}(\overline{X}_m - \overline{X}_f) + \beta_{\mathrm{m}}(\lambda_m - \lambda_f)]$ or $[\beta_{\mathrm{f}}(\overline{X}_f - \overline{X}_m) + (\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\lambda_f]$, whereas the unexplained component was calculated as $[(\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\overline{X}_f + (\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\lambda_f]$ or $[(\beta_{\mathrm{f}} - \beta_{\mathrm{m}})\overline{X}_m + (\beta_{\mathrm{f}} - \beta_{\mathrm{m}})\lambda_m]$

$$\overline{LnW_m} - \overline{LnW_f} = \beta_{\mathrm{m}}(\overline{X}_m - \overline{X}_f) + (\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\overline{X}_f + \beta_{\mathrm{m}}(\lambda_m - \lambda_f) + (\beta_{\mathrm{m}} - \beta_{\mathrm{f}})\lambda_f \tag{9}$$

$$\overline{LnW_m} - \overline{LnW_f} = \beta_{\mathrm{f}}(\overline{X}_f - \overline{X}_m) + (\beta_{\mathrm{f}} - \beta_{\mathrm{m}})\overline{X}_m + \beta_{\mathrm{f}}(\lambda_f - \lambda_m) + (\beta_{\mathrm{f}} - \beta_{\mathrm{m}})\lambda_m \tag{10}$$

3.2. Data

We used the survey data of CHIPs2002 and CHIPs2018 for the analysis. The data were compiled by the Economic Institute of the Chinese Academy of Social Science and Beijing Normal University in 2003 and 2019 using stratified random sampling based on samples from the National Bureau Statistics. The same information for analysis of the two time-points could be used because of the questionnaire design similarities. As the sampling standards (sampling weights) are the same in both surveys, we can compare the results across two time-points.[6]

The CHIP survey covers representative regions of China and provides rich information on wages, work, and individual and family attributes. We focused on working individuals in urban China. Considering the sample selection bias for the choice of work or non-work, we used the working and non-working urban individual samples. We also limited the sample to individuals aged 16–60 years, in consideration of the retirement system implemented in SOEs and government organizations. We deleted samples with no responses, abnormal values,[7] and missing values.

In the wage function, we used the logarithm of hourly wage as the dependent variable. Hourly wage is calculated as the total annual wage divided by the annual work hours. Wages refer to the total earnings from work, whereas annual work hours are calculated as follows: number of working hours daily × number of working days monthly × number of working months yearly. In our study, we included basic wages, bonuses, and subsidies, calculated based on market prices. We used the consumer price index in 2002 as the standard to adjust the nominal wage every year.

The independent variables were the variables likely to affect the wage level. The main independent variables were the indicators of the family gap (or parenthood). In previous studies, the parenthood status has been used to measure the influence of parenthood on wage gaps, as (i) the total number of children, which is a continuous variable (Budig & England, 2001; Gangl & Ziefle, 2009), or (ii) a

[6] Numerous empirical studies based on the CHIPs used a two time-points survey and took the comparison of results. For example, Gustafsson and Li (2000) used CHIPs 1988 and CHIPs1995 to estimate the wage function in two time points and to decompose the gender wage gap. They pointed out that the gender wage gap expanded, and the effects of education in explained part increased during the period.

[7] Abnormal values are those not in the range of "mean value ± three times SD."

set of dummy variables of parenthood status, such as childless, one child, two children, and three or more children dummy variables (Budig & England, 2001; Davies & Gaëlle, 2005; Waldfogel, 1998). Our study also included a dummy variable for "having a child" (1 = having one or more children, 0 = childless). These three types of parenthood indicators were used in this study.

For the other control variables, years of schooling, years of working experience,[8] and health status (1 = "very good" or "good"; otherwise, 0) were considered as the indices of human capital. Given that ethnicity may affect wages, we included a Han ethnicity dummy variable (1 = Han ethnicity, 0 = minority ethnicity). Studies have also reported a wage premium for Communist Party membership in China (Ma & Iwasaki, 2021; Ma, 2019). Thus, we included a party dummy variable (1 = Communist Party member, 0 = otherwise). We also used regional dummy variables to control the influences of the regional disparity in economic development levels and labor markets differ by region. Meanwhile, we calculated the selection bias correction item based on a probit regression model used in the Heckman two-step model. Two variables of age and household income excluding the respondent' earned income are used in the first-step estimation of the Heckman two-step model as the identification variables.

Lastly, although occupation, workplace ownership type, and industry sector may influence wage levels, the usage of these variables is debated because of the role played by women's self-selection for motherhood, where the results have been mixed (Budig & England, 2001; Felfe, 2012; Looze, 2017; Simonsen & Skipper, 2006; Waldfogel, 1997). For example, Budig and England (2001) and Felfe (2012) pointed out that the influence of mothers' work adjustments (e.g., changes in occupation or job) after childbirth on wages is small, whereas Simonsen and Skipper (2006) found that mothers tend to choose a family-friendly public sector, where wages are lower than those in the private sector. Regarding the mixed results of self-selection, we used a model that included occupation, ownership sector, and industrial sector dummy variables as main estimates. We also employed wage functions that excluded these factors to check for robustness. Thus, our model included five types of occupation dummy variables (managers, professional workers and technicians, production workers, clerical staff, and others), five types of workplace ownership dummy variables (PUB: public sector, including government organization and SOEs; collectively owned enterprises (COEs); POEs; foreign-owned enterprises (FOEs); and others), and five kinds of industrial sector dummy variables (construction, manufacturing, sales/catering, service, and others).

4. Descriptive statistics results

4.1. Differences in individual characteristics between men and women workers

The mean values of the variables for the worker groups are shown in Table 1. The proportion of the group with a child was slightly higher for women than for men, as were the proportions of the group with two and three or more children. However, the gender gap in the number of children and proportion of the group having a child was small, which indicated that the differences in parenthood situation by gender was small in both 2002 and 2018.

Regarding the number of years of experience, men were found to have worked longer than women by about two years; the gender gap in this variable was small. In 2002, the number of years of schooling was slightly higher for men than for women, whereas in 2018, women had overtaken men. The gender gap in human capital was small in both 2002 and 2018.

The proportion of Communist Party members was higher for men than women in both 2002 and 2018 (the gap was 13.6% for 2002 and 7.3% for 2018). Meanwhile, the gender gaps in health status, ethnicity, and distribution proportion by region were small.

We also found gender gaps in the distribution proportions of types of occupation, industry, and ownership in both 2002 and 2018. For example, the proportion of managers was higher for men than women (the gap was 7.6% for 2002 and 9.4% for 2018). The proportion of working in the public sector was also higher for men than women, whereas women dominated POEs. The proportion of those working in the construction and manufacturing industrial sectors was higher for men than women, whereas women outnumbered men in the sales/retail and service industrial sectors in both 2002 and 2018.

The results suggested gender gaps in having a child, number of children, human capital, party membership, and workplace sectors. These factors can be expected to continue to affect the gender gap.

4.2. Gender gap in employment rate and mean values of wage by parenthood status

We calculated the employment rate and mean values of wage by gender and by four types of parenthood status: childless, having one child, having two children, and having three or more children. The results are shown in Table 2.

Regarding the gender gap in employment, the employment rate was lower for women than for men in both 2002 and 2018. This may be because of the discrimination against women or the self-selection by married women during childrearing periods. In 2002, the gender gap in employment rate was the highest for the childless group (−29.3%), whereas in 2018, it was the highest for those with three or more children (−28.0%). The results may be caused by a change in the female work-family environment during the period.

For the gender wage gap, we calculated monthly and hourly wages, and found that the gender wage gap was larger for monthly than for hourly wages, possibly because the working hours tended to be longer for men than for women. Considering the influence of the gender gap in working hours, we opted to use hourly wages in the analysis. We used the results for hourly wages to discuss the gender wage gap by group.

The indicator of the gender wage gap was the ratio of women to men in the workforce. The results showed a sustained gender wage

[8] Years of experience = age-6-years of schooling.

Table 1
Statistical descriptions by gender.

	2002			2018		
	Male	Female	D	Male	Female	D
Child	90.3%	90.9%	-0.6%	83.8%	85.3%	-1.5%
Number of children	1.276	1.229	0.047	1.026	1.031	-0.005
Child category						
Childless	9.7%	9.1%	0.6%	26.2%	24.7%	1.5%
One child	63.3%	67.1%	-3.9%	51.9%	54.0%	-2.2%
Two children	18.6%	17.0%	1.7%	17.1%	16.6%	0.4%
Three+	8.4%	6.8%	1.6%	4.9%	4.7%	0.2%
Exp.	29.862	27.415	2.446	23.500	21.194	2.307
Years of schooling	11.620	11.488	0.132	12.123	12.262	-0.140
Health	70.1%	65.3%	4.8%	82.8%	82.8%	0.1%
Han	95.9%	95.9%	0.0%	96.2%	95.3%	0.9%
Party	35.6%	22.0%	13.6%	23.7%	16.4%	7.3%
Occupation category						
Manager	40.3%	32.7%	7.6%	30.3%	20.9%	9.4%
Prof. and Tech.	17.9%	24.0%	-6.1%	24.4%	29.4%	-5.0%
Prod. Worker	32.9%	23.4%	9.5%	13.1%	5.7%	7.4%
Clerical staff	7.1%	17.4%	-10.2%	15.9%	27.6%	-11.6%
Others	1.7%	2.4%	-0.7%	16.3%	16.5%	-0.1%
Ownership category						
PUB	70.2%	64.4%	5.8%	37.2%	33.0%	4.1%
COE	5.5%	8.9%	-3.5%	2.7%	2.5%	0.2%
FOE	2.3%	2.1%	0.2%	2.6%	2.2%	0.3%
POE	20.4%	20.9%	-0.6%	42.8%	45.0%	-2.2%
Others	1.7%	3.6%	-1.9%	14.8%	17.2%	-2.4%
Industry category						
Cons.	4.1%	2.2%	1.9%	9.4%	2.6%	6.8%
Manu.	27.0%	24.0%	3.0%	13.7%	10.0%	3.7%
Retail.	9.7%	14.3%	-4.6%	12.2%	20.6%	-8.4%
Service	40.1%	44.7%	-4.6%	19.8%	23.3%	-3.4%
Others	19.1%	14.7%	4.4%	45.0%	43.6%	1.4%
Region category						
East	38.7%	39.2%	-0.5%	42.2%	42.9%	-0.6%
Central	35.4%	32.9%	2.5%	35.9%	34.6%	1.3%
West	25.8%	27.9%	-2.0%	21.9%	22.6%	-0.7%
No. of observations	5186	3941		6098	4851	

Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

gap in 2002 and 2018 (ranging from 85.5% to 90.0% in 2002, and from 77.0% to 92.4% in 2018). Except for the group with three or more children, the gender wage gap increased for the childless, one child, and two children groups from 2002 to 2018. For the wage gaps between childless men and fathers, the average wage level was lower for the father groups in 2002 (94.1% for one child, 73.5% for two children, 70.9% for three or more children), particularly for fathers with two or more children. We observed a similar tendency among women. In 2018, compared with the childless men group, the average wage level was higher for fathers with one child (112.8%) or two children (100.7%). It was also higher for mothers with one child (103.5%) but lower for those with two children (89.4%). Thus, for men, the influence of parenthood on wage changed from "parenthood wage penalty" to "parenthood wage premium" from 2002 to 2018, whereas in women, the parenthood wage penalty tended to persist.

These results indicated that the employment rate and wage levels differed by gender: The employment rate is lower for women than men in both the childless and with child groups; the gender wage gaps vary among the childless and parent groups; the wage gaps between the childless group and the group having children differed for men and women. However, other factors that may affect wages had not been controlled in these results. To clarify how these factors (particularly parenthood) contribute to the formation of the gender wage gap, we conducted an econometric analysis.

5. Econometric analysis results

5.1. Is there a gender wag gap in urban China?

When other factors are held constant, is there a gender wage gap in China? The results of the wage function using the total sample are presented in Table 3. Models 1–4 are distinguished by the different dependent variables used. In Model 5, we used the Heckman two-step model to correct the sample selection bias caused by the choice of work or non-work. In Model 6, we used the nonlinearity variables of the number of children (childless, one child, two children, three or more children dummy variables).

The results from Models 1–4 revealed a gender gap in both 2002 (8.5–17.4%) and 2018 (13.9–21.0%), in urban China, even when the other factors, including productivity factors (e.g., education), were held constant. The results from Model 6 indicated the gender

Table 2
Gender gaps of employment rate and wages by parenthood status.

	2002			2018		
	Male	Female	Gender gap	Male	Female	Gender gap
Employment rate						
a: Childless	75.5%	46.2%	-29.3%	86.3%	66.0%	-20.3%
b: One	88.1%	70.2%	-17.9%	80.3%	62.9%	-17.4%
c: Two	55.9%	43.9%	-12.0%	80.2%	58.1%	-22.1%
d: Three+	60.8%	43.6%	-17.2%	81.9%	53.9%	-28.0%
b/a	116.7%	190.7%		93.0%	95.3%	
c/a	74.0%	121.0%		92.9%	88.0%	
d/a	80.5%	131.6%		94.9%	81.7%	
Monthly wage (Yuan)						
a: Childless	1115	833	74.7%	4523	2778	61.4%
b: One	1125	841	74.8%	4724	2816	59.6%
c: Two	885	714	80.7%	4553	2218	48.7%
d: Three+	846	672	79.4%	4204	1760	41.9%
b/a	100.9%	101.0%		104.4%	101.4%	
c/a	79.4%	85.7%		100.7%	79.8%	
d/a	75.9%	80.7%		92.9%	63.4%	
Hourly wage (Yuan)						
a: Childless	7.206	6.276	87.1%	29.028	25.176	86.7%
b: One	6.783	5.798	85.5%	32.750	26.060	79.6%
c: Two	5.293	4.764	90.0%	29.244	22.504	77.0%
d: Three+	5.107	4.577	89.6%	26.443	24.434	92.4%
b/a	94.1%	92.4%		112.8%	103.5%	
c/a	73.5%	75.9%		100.7%	89.4%	
d/a	70.9%	72.9%		91.1%	97.1%	

Notes: Gender gap of employment rate=Female-Male; gender wage gap=Female/Male
Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

gaps are 8.6% in 2002 and 14.0% in 2018, which confirmed the findings from Models 1–4. These results suggest that gender wage gap was maintained in urban China in both 2002 and 2018.

When controlling for the factors related to self-selection (e.g., occupation, industry, ownership sectors) (see Model 4), the gender wage gap decreased greatly, suggesting that self-selection significantly influenced the gender wage gap. Furthermore, the results of the correction item (inverse Mill's ratio) were positive and statistically significant at the 1% level, indicating that when the sample selection bias is not addressed, the wage levels may be underestimated (Model 5). When the sample selection bias was considered, the gender wage gap was not statistically significant. These results suggested that self-selection might greatly affect the gender wage gap.

5.2. How does parenthood affect wage levels?

We examined whether a parenthood wage penalty existed in China, and whether the effect of parenthood differed by gender. We estimated the wage functions using the total sample and subsamples (men and women), and the results are shown in Table 3 (total) and Table 4 (by gender), respectively.

Table 3 shows significant negative coefficients for number of children, ranging from − 15.5% to − 7.5% in Models 2–4 for 2002, and a significant positive value (4.9%) in Model 5 for 2018. These results confirmed a parenthood wage penalty in 2002 and a parenthood wage premium in 2018. The results in Models 2 and 3 showed that when the human capital factors were controlled, the magnitude of the parenthood effect changed greatly in both 2002 and 2018. Hence, the human capital factor should be controlled when discussing the effect of parenthood on wages.

Regarding the parenthood effect by gender, we performed estimations by men and women. Three types of indicators of parenthood were used in Models 1–3 separately: (i) having children binary dummy, (ii) number of children, and (iii) child status category dummy. The results are summarized in Table 4.

The results confirmed a difference in the parenthood effect on wages between men and women in both 2002 and 2018. Concretely, in 2002, although the parenthood effect showed a significant negative value in Models 1–3 for both gender groups (columns a and b), the magnitudes of these coefficients were larger for women than men. In addition, the coefficients of interaction of parenthood factors and female dummy variables in Models 1 and 3 (columns c and f) are significantly negative at the 5% and 10% levels. These results indicated that the parenthood wage penalty was greater for women than for men in 2002. In 2018, the parenthood effect values became positive (columns d and e), but they were only statistically significant for men. Furthermore, the coefficients of interaction of parenthood factors and female dummy variables in both Models 1 and 3 (column f) are negative and significant at the 10% level. These results indicated that the parenthood wage penalty was greater for women than men in 2018. To sum up, the parenthood wage premium was lower, and the parenthood wage penalty was higher for women than for men during the study period.

Moreover, the parenthood effect on wages differed according to the number of children. In 2002, the parenthood wage penalty increased with the number of children for both gender groups (columns a and b); in 2018, the parenthood wage premium was confirmed only for men (columns d and e).

Table 3
Results of wage function (total samples).

	(1)		(2)		(3)		(4)		(5)		(6)	
Panel A:2002												
Gender	-0.174	***	-0.174	***	-0.110	***	-0.085	***	0.019		-0.086	***
	(−12.17)		(−12.17)		(−8.08)		(−6.48)		(0.97)		(−6.55)	
Number of children			-0.155	***	-0.089	***	-0.077	***	-0.075			
			(−17.10)		(−9.61)		(−8.75)		(−8.58)			
Child category (Childless)												
One child											0.002	
											(0.08)	
Two children											-0.117	***
											(−4.39)	
Three+ children											-0.216	***
											(−6.78)	
Education					Yes		Yes		Yes		Yes	
Experience					Yes		Yes		Yes		Yes	
Party					Yes		Yes		Yes		Yes	
Health					Yes		Yes		Yes		Yes	
Occupation							Yes		Yes		Yes	
Ownership							Yes		Yes		Yes	
Industry							Yes		Yes		Yes	
Region	Yes		Yes		Yes		Yes		Yes		Yes	
Inverse Mill's ratio									0.192	***		
									(7.05)			
Panel A:2018												
Gender	-0.210	***	-0.210	***	-0.194	***	-0.139	***	0.018		-0.140	***
	(−9.06)		(−9.06)		(−8.63)		(−6.05)		(0.71)		(−6.08)	
Number of children			-0.011		0.021		0.019		0.049	***		
			(−0.82)		(1.55)		(1.43)		(3.66)			
Child category (Childless)												
One child											0.042	
											(1.52)	
Two children											0.052	
											(1.47)	
Three+ children											0.061	
											(1.11)	
Education					Yes		Yes		Yes		Yes	
Experience					Yes		Yes		Yes		Yes	
Party					Yes		Yes		Yes		Yes	
Health					Yes		Yes		Yes		Yes	
Occupation							Yes		Yes		Yes	
Ownership							Yes		Yes		Yes	
Industry							Yes		Yes		Yes	
Region	Yes		Yes		Yes		Yes		Yes		Yes	
Inverse Mill's ratio									0.359	***	0.359	***
									(15.16)		(15.16)	

Notes: *: $p < 0.1$; **: $p < 0.05$: ***: $p < 0.01$; Yes: covariates are controlled in models; the results are not expressed in the table and available on request. Numbers in parentheses are the *t*-values.
Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

5.3. Which factor influences the gender wage gap?

The decomposition results based on the Blinder–Oaxaca model are presented in Table 5. We examined how differences in endowment (explained component) and discrimination against women (unexplained component) affected the gender wage gap. The contribution rate of unexplained components (52.7% in 2002, 69.3% in 2018) was greater than that of the explained component (47.3% in 2002, 30.7% in 2018) in both 2002 and 2018. The unexplained component may thus be the main factor underlying the gender wage gap in both 2002 and 2018, and its influence increased from 2002 to 2018, indicating that discrimination against women workers increased during this period.

Regarding the effect of parenthood on the gender wage gap, we evaluated the total contribution rate of the number of children; the explained component showed a small negative value (−3.7% in 2002, −0.5% in 2018) whereas the unexplained component showed a large positive value (63.3% in 2002, 35.3% in 2018). Thus, the parenthood wage penalty was greater for women workers and contributed to the formation of the gender wage gap in both 2002 and 2018. Nonetheless, the influence of the gender gap in parenthood wage penalty decreased from 2002 to 2018 (63.3% in 2002, 35.3% in 2018). The progress of market-oriented reform in the 2000 s may have decreased the discrimination against the working mother group.

Regarding the differences in parenthood effect on wages by number of children in the unexplained components, the contribution rate was greater for the one child group (63.3% in 2002, 35.3% in 2018), compared with the two and three or more children groups.

Table 4
Results of wage function by gender based on the Heckman two step model.

	2002						2018					
	M (a)		F (b)		Total (c)		M (d)		F (e)		Total (f)	
(1) Model 1												
Having child dummy	-0.011		-0.121	***	-0.017		0.146	***	0.053		0.153	***
	(−0.38)		(−3.41)		(−0.59)		(4.18)		(1.30)		(4.49)	
Having child dummy × female					-0.087	**					-0.090	*
					(−2.01)						(−1.80)	
(2) Model 2												
Number of children	-0.075	***	-0.075	***	-0.077	***	0.050	***	0.021		0.058	***
	(−6.85)		(−5.23)		(−7.09)		(2.84)		(1.04)		(3.33)	
Number of children × female					0.004						-0.040	
					(0.24)						(−1.55)	
(3) Model 3												
Child category (Childless)												
One child	0.024		-0.090	**	0.021		0.146	***	0.052		0.149	***
	(0.81)		(−2.51)		(0.73)		(3.98)		(1.24)		(4.15)	
Two children	-0.078	**	-0.206	***	-0.082	**	0.141	***	0.041		0.154	***
	(−2.29)		(−4.86)		(−2.42)		(3.01)		(0.77)		(3.34)	
Three+ children	-0.205	***	-0.242	***	-0.210	***	0.167	**	0.096		0.195	***
	(−5.11)		(−4.64)		(−5.23)		(2.30)		(1.14)		(2.71)	
One child × female					-0.100	**					-0.081	
					(−2.30)						(−1.54)	
Two children × female					-0.115	**					-0.110	*
					(−2.27)						(−1.63)	
Three and more children × female					-0.019						-0.120	
					(−0.30)						(−1.10)	

Notes:
1.*: $p < 0.1$; **: $p < 0.05$: ***: $p < 0.01$. M: males; F: females. Numbers in parentheses are the *t*-values.
2. The common covariates including years of experience, years of experience squared, health, party, Han ethnicity, occupation, ownership sector, industry, region, and the inverse Mill's ratio were used; the female dummy variable was added in columns c and f. Two variables of age and household income excluding the respondent' earned income were used as the identification variables in the first step of the Heckman two step model. The results are not expressed in the table and available on request.
Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

Thus, the discrimination against women workers was the greatest for mothers who had their first child. Indeed, having one's first child caused a large motherhood wage penalty.

We also identified the factor with the greatest influence on expanding the gender wage gap. In the explained components, the factor with the highest value obtained was occupation (15.1% in 2002, 18.8% in 2018); in the unexplained components, the factors were children (63.3%) in 2002, and industry (71.6%) and child (35.3%) in 2018. The results indicated that gender occupational segregation, gender gap of parenthood wage penalty (or parenthood wage premium), and gender gap of returning to industrial sectors were the main factors contributing to the formation of the gender wage gap.

5.4. How does the family gap affect the gender wage gap?

The results for the unexplained components indicated that the number of children may contribute to expanding the gender wage gap. We next clarified whether there is a fatherhood wage premium within the men workers group and motherhood wage penalty within the women workers group, and how these two inversed effects contributed to the formation of the gender wage gap. To explore the family gap influences on the gender wage gap, we performed estimations based on the Cukrowska-Torzewska and Lovasz decomposition model.

As shown in Table 6, for the men workers group, the total values, including the explained and unexplained components, were − 69.0% in 2002 and 47.2% in 2018. The fatherhood wage penalty in 2002 evolved into a fatherhood wage premium in 2018. When the other factors, including human capital, were held constant, suggesting the effect of the fatherhood wage premium increased significantly and contributed to expanding the gender wage gap in 2018. Among women, the total values were negative in both 2002 and 2018 (−91.8% in 2002, −6.0% in 2018). The results pointed to a parenthood wage penalty for women workers in 2002 and 2018. Compared with childless women, working mothers faced discrimination within the women workers group, which contributed greatly to the formation of the gender wage gap. However, the contribution rate of motherhood wage penalty decreased from 2002 to 2018. Meanwhile, the gender wage gap in the childless group also helped expanding the overall gender wage gap, with contribution rates of 77.2% in 2002 and 46.7% in 2018.

Regarding the magnitude of the three kinds of components, our results showed that in 2002, the contribution rate was highest for the motherhood wage penalty within the female group (−91.8%); in 2018, it was highest for fatherhood wage premiums among male workers (47.2%). The results reveal that from 2002 to 2018, although the motherhood wage penalty decreased, while the fatherhood

Table 5
Decomposition results of gender wage gap based on the Blinder-Oaxaca model.

	Value		Percentage	
	Explained	Unexplained	Explained	Unexplained
Panel A: 2002				
Wage gap= 0.164	**0.078**	**0.087**	**47.3%**	**52.7%**
Child: Total	***-0.006***	***0.104***	***-3.7%***	***63.3%***
One child	***-0.002***	***0.079***	***-1.2%***	***48.0%***
Two children	***-0.001***	***0.022***	***-0.6%***	***13.3%***
Three+ children	***-0.003***	***0.003***	***-1.9%***	***2.0%***
Exp.	0.022	0.031	13.6%	18.9%
Education	0.007	-0.139	4.3%	-84.4%
Health	0.000	0.011	0.0%	6.4%
Han	0.000	0.085	0.0%	51.9%
Party	0.012	0.000	7.3%	0.0%
Occupation	0.025	-0.041	15.1%	-24.8%
Ownership	0.019	0.009	11.3%	5.5%
Industry	0.002	0.031	1.1%	18.7%
Region	-0.003	-0.002	-1.7%	-1.1%
Constant	0.000	-0.002	0.0%	-1.8%
Panel B: 2018				
Wage gap= 0.208	**0.064**	**0.144**	**30.7%**	**69.3%**
Child: Total	***-0.001***	***0.073***	***-0.5%***	***35.3%***
One child	***-0.002***	***0.053***	***-0.8%***	***25.4%***
Two children	***0.000***	***0.019***	***0.2%***	***8.9%***
Three+ children	***0.000***	***0.002***	***0.1%***	***0.9%***
Exp.	0.015	0.134	7.3%	64.3%
Education	-0.011	-0.089	-5.2%	-42.6%
Health	0.000	-0.028	0.0%	-13.6%
Han	0.000	-0.009	0.2%	-4.5%
Party	0.006	-0.007	2.7%	-3.2%
Occupation	0.039	-0.212	18.8%	-102.1%
Ownership	0.005	0.038	2.5%	18.1%
Industry	0.012	0.149	5.7%	71.6%
Region	-0.001	0.001	-0.8%	0.5%
Constant	0.000	0.094	0.0%	45.6%

Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

wage premium increased from 2002 to 2018. In addition, the contribution rates of the gender wage gap within the childless group also contribute to the formation of the gender wage gap (77.2% in 2002, 46.7% in 2018).

5.5. Robustness checks

The self-selection of parenthood and work status (e.g., occupation, industrial, and ownership sectors) has been argued to impact the gender wage gap (Budig & England, 2001; Felfe, 2012; Looze, 2017; Nielsen et al., 2004; Simonsen & Skipper, 2006; Waldfogel, 1997). We employed a decomposition method based on the Blinder–Oaxaca model, excluding the occupation, industrial, and ownership sector dummy variables. The results for the number of children are summarized in Table 7.

Although the contribution rates of the unexplained component increased in Table 7 from those in Table 5 (68.8% in 2002 and 95.4% in 2018 in Table 7; 52.7% in 2002 and 69.3% in 2018 in Table 5), the change in the contribution rates of parenthood in the unexplained components was smaller in both 2002 and 2018 (2002: 63.3% in Tables 5 and 56.3% in Table 7; 2018: 35.3% in Tables 5 and 35.7% in Table 7). The results on the influence of parenthood on the gender wage gap in Table 7 nearly matched those in Table 5. Thus, the influence of the self-selection bias on the estimations was smaller. Consequently, the conclusions on the association between parenthood and the gender wage gap were robust.

Regarding the influence of sample selection bias on the wage gap, we also employed decomposition based on the Oaxaca–Choe model (Table 8). The magnitude of the contribution rates of the explained component was expected to be greater in both 2002 and 2018, with respect to the results in Tables 5 and 8, when considering the sample selection bias in the OLS wage function. However, the change in contribution rates of parenthood was smaller: from 63.3% in Tables 5 to 61.2% in Table 8, for 2002, and from 35.3% in Tables 5 to 33.5% in Table 8 for 2018. Despite the sample selection bias, the discrimination faced by working mothers remained greater compared with working fathers, which may expand the gender wage gap. Thus, the robustness check confirmed the influence of parenthood on the gender wage gap.

6. Conclusions

Using data from CHIPs2002 and CHIPs2018 and decomposition methods, this study explored the influence of parenthood on the gender wage gap in urban China. Selection bias tests were also performed to check for robustness.

Table 6
Decomposition results of gender wage gap based on the Cukrowska-Torzewska and Lovasz model.

	(1) Male			(2) Female			(3) Childless		
	Child vs. Childless			Child vs. Childless			Males vs. Females		
	Explained	Unexplained	Total	Explained	Unexplained	Total	Explained	Unexplained	Total
Panel A: 2002									
Contribution rate	***-77.2%***	***8.2%***	***-69.0%***	***-39.0%***	***-52.8%***	***-91.8%***	***94.3%***	***-17.1%***	***77.2%***
Exp.	-42.2%	332.7%	290.6%	-37.2%	58.1%	20.9%	24.3%	-259.6%	-235.3%
Education	3.3%	28.4%	31.7%	16.7%	172.2%	189.0%	13.9%	75.1%	89.0%
Health	-0.5%	-29.1%	-29.6%	-0.5%	-10.8%	-11.4%	0.8%	22.1%	22.9%
Han	-0.3%	27.8%	27.5%	1.2%	-112.8%	-111.6%	0.0%	-92.7%	-92.7%
Party	-8.9%	-10.8%	-19.8%	-4.7%	3.4%	-1.4%	16.7%	10.8%	27.5%
Occupation	-15.7%	22.4%	6.7%	-14.1%	-44.9%	-59.0%	1.9%	-81.1%	-79.2%
Ownership	-12.8%	5.5%	-7.3%	-8.1%	4.0%	-4.1%	23.7%	-5.0%	18.7%
Industry	-3.8%	-17.8%	-21.6%	-1.7%	-71.0%	-72.7%	10.4%	-40.3%	-29.9%
Region	3.8%	-33.8%	-30.0%	9.5%	-78.4%	-69.0%	2.6%	-45.8%	-43.2%
Constants	0.0%	-317.1%	-317.1%	0.0%	27.4%	27.4%	0.0%	399.4%	399.4%
Panel B: 2018									
Contribution rate	***15.2%***	***32.0%***	***47.2%***	***-2.6%***	***-3.5%***	***-6.0%***	***19.4%***	***27.3%***	***46.7%***
Exp.	21.6%	-52.9%	-31.3%	12.4%	-31.6%	-19.2%	9.3%	57.3%	66.6%
Education	-11.5%	-135.1%	-146.6%	-16.8%	45.4%	28.6%	-9.5%	141.8%	132.3%
Health	-0.4%	-33.3%	-33.7%	0.5%	-4.5%	-4.0%	1.8%	15.5%	17.3%
Han	0.0%	38.0%	38.0%	0.5%	79.4%	79.8%	-0.3%	34.5%	34.2%
Party	1.8%	4.7%	6.4%	0.8%	2.1%	2.9%	0.5%	-4.7%	-4.2%
Occupation	3.8%	14.5%	18.2%	-0.9%	-61.8%	-62.7%	15.5%	-177.0%	-161.5%
Ownership	0.7%	-12.5%	-11.7%	3.9%	-33.4%	-29.5%	1.2%	1.9%	3.1%
Industry	1.6%	-28.6%	-27.0%	1.5%	-19.2%	-17.7%	2.4%	82.5%	84.9%
Region	-2.4%	-16.6%	-19.0%	-4.4%	-20.9%	-25.2%	-1.5%	-5.5%	-7.0%
Constants	0.0%	253.7%	253.7%	0.0%	41.0%	41.0%	0.0%	-118.9%	-118.9%

Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

Table 7
Decomposition results of gender wage gap.

	Value		Percentage	
	Explained	Unexplained	Explained	Unexplained
Panel A: 2002				
Wage gap= 0.164	0.053	0.118	31.2%	68.8%
Child: Total	-0.006	0.096	-3.6%	56.3%
One child	-0.001	0.073	-0.6%	42.7%
Two children	-0.002	0.020	-1.0%	11.5%
Three+ children	-0.003	0.003	-2.0%	2.0%
Panel B: 2018				
Wage gap= 0.208	0.010	0.208	4.6%	95.4%
Child: Total	-0.001	0.078	-0.4%	35.7%
One child	-0.001	0.048	-0.6%	22.2%
Two children	0.000	0.028	0.1%	12.9%
Three+ children	0.000	0.001	0.1%	0.6%

Notes:
1. Blinder-Oaxaca decomposition model is used.
2. The decomposition results of education, years of experience, health, Han ethnicity, party and region variables are not expressed in the table.
Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

Our analyses confirmed a gender wage gap in urban China, which increased from 2002 (8.5–17.4%) to 2018 (13.9–21.0%). The results based on the wage function indicated a parenthood wage penalty in 2003 and a parenthood wage premium in 2018. A parenthood wage penalty for women workers existed in both 2002 and 2018, and the parenthood wage premium was greater for men than for women in 2018.

The decomposition results based on the Blinder–Oaxaca model revealed that the parenthood wage penalty was greater for women than for men, which contributed to the formation of the gender wage gap in both 2002 and 2018. The parenthood wage penalty was particularly marked for parents with one child, compared with those having two or more children, in both 2002 and 2018. The results of the robustness checks considering the sample selection biases confirmed these conclusions.

Meanwhile, the decomposition results based on the model of Cukrowska-Torzewska and Lovasz indicated that the motherhood wage penalty, fatherhood wage premium, and gender wage gap within the childless worker group also contributed to the formation of the gender wage gap. The comparison of the contribution rate between two periods reveals that the value of the motherhood wage penalty is smaller, whereas that of the fatherhood wage premium is larger in 2018.

Table 8
Decomposition results of gender wage gap considering sample selection bias.

	Value		Percentage	
	Explained	Unexplained	Explained	Unexplained
Panel A: 2002				
Wage gap= 0.164	**0.171**	**-0.006**	**104.0%**	**-4.0%**
Child: Total	***-0.006***	***0.101***	***-3.4%***	***61.2%***
One child	***-0.001***	***0.076***	***-0.6%***	***46.5%***
Two children	***-0.001***	***0.022***	***-0.8%***	***13.1%***
Three+ children	***-0.003***	***0.003***	***-2.0%***	***1.5%***
Exp.	0.040	0.038	24.6%	23.0%
Education	0.006	-0.110	3.8%	-67.3%
Health	-0.001	0.011	-0.7%	6.7%
Han	0.000	0.078	0.0%	47.3%
Party	0.006	0.000	3.6%	0.3%
Occupation	0.025	-0.042	15.1%	-25.6%
Ownership	0.018	0.009	11.2%	5.4%
Industry	0.002	0.029	1.0%	17.6%
Region	-0.002	-0.004	-1.4%	-2.4%
Correction item	0.082	-0.060	50.2%	-36.3%
Constant	0.000	-0.056	0.0%	-34.0%
Panel B: 2018				
Wage gap= 0.208	**0.237**	**-0.029**	**113.6%**	**-13.6%**
Child: Total	***-0.002***	***0.071***	***-1.0%***	***33.5%***
One child	***-0.003***	***0.051***	***-1.5%***	***24.1%***
Two children	***0.001***	***0.017***	***0.3%***	***7.9%***
Three+ children	***0.000***	***0.003***	***0.2%***	***1.6%***
Exp.	0.028	0.033	13.5%	15.7%
Education	-0.009	-0.114	-4.3%	-54.1%
Health	0.000	-0.037	0.0%	-17.5%
Han	0.000	-0.015	0.1%	-7.2%
Party	-0.003	-0.010	-1.6%	-5.0%
Occupation	0.036	-0.223	17.2%	-106.2%
Ownership	0.007	0.027	3.2%	12.9%
Industry	0.011	0.142	5.1%	67.5%
Region	-0.001	0.003	-0.7%	1.6%
Correction item	0.170	0.086	82.0%	41.0%
Constant	0.000	0.008	0.0%	4.1%

Notes: Oaxaca-Choe decomposition model is used.
Source: Calculated based on the data from CHIPs2002 and CHIPs2018.

As such, we formulated a number of policy implications. First, our results confirmed the gender wage gap in urban China, which showed a widening trend from 2002 to 2018. The results indicated that a parenthood wage penalty existed in both 2012 and 2018, and the parenthood wage penalty is greater for women in both 2002 and 2018, suggesting possible discrimination against married women workers in workplace which has widened the gender wage gap from 2002 to 2018. The Chinese government has introduced policies and regulations since the 1980 s to address the gender gap in labor markets. For example, the central government implemented a compulsory education policy and increased public education subsidies for poorer rural regions. It is expected that these policies may decrease gender differences in educational attainment levels.[9] The Labor Law (*Laodong Fa*) was published in 1995, and the Labor Contract Policy (*Laodong Hetong Fa*) was promulgated in 2008. These labor policies protect the rights of workers regardless of gender, and aim to promote equality of employment and wages. However, given that the gender wage gap expanded from 2002 to 2018, employment equality labor policies should be enforced in China to reduce the gender differences in the influence of parenthood on wage: the fatherhood wage premium and motherhood wage penalty.

Second, the parenthood wage penalty was the greatest for the one-child mother group. Although this group can be assumed to carry less childcare responsibility compared with mothers with two or more children, the findings may be explained by the discrimination faced by mothers after having their first child. The discrimination causes a reduction in the wage level of the mother group, and as such, even though the Chinese government has deregulated the one-child policy since the 2000 s, the total fertility rate in China remains low in the current period. Therefore, to address the problem of shortage in the labor force and population aging in China, the government should implement not only population regulation policy reform but also labor policies that reduce discrimination against married women who decide to have children. Referring to experiences in other countries, such as in Europe and Japan, the establishment and enforcement of family-friendly labor policies (e.g., flexible working hours and family care leaves) are important issues for the Chinese government.

[9] Based on the third CFSSS data, the gender gap in schooling years decreased from 1.9 years in 1990 (men, 6.6 years; female, 4.7 years) to 0.3 years in 2010 (men, 9.1 years; women, 8.8 years).

Third, although this study focused on the gender gap among working group and considered the self- and sample-selection bias, it should be noted that a change in employment status during the parenthood period can affect the gender wage gap. Table 2 indicated that the employment rate was lower for women than for men in both 2002 and 2018, suggesting discrimination against women experiencing motherhood, both in employment and wages. Numerous empirical studies have found a negative relationship between childcare and mothers' employment (Andrew, 2010; Angrist & Evans, 1998; Connelly, Dong, Jacobsen, & Zhao, 2018; Ma, 2021). The discrimination against married women can be addressed by enforcing the implementation of employment equality policies.

Finally, this study has several limitations. First, although we used a set of models for the robustness checks that accounted for self- and sample selection biases, we could not address endogeneity problems, such as those at the individual level. Future research should also explore the causality between parenthood and the gender wage gap. Second, as the gender gap in employment is closely related with gender wage gap, future research can empirically explore the causality relationship between motherhood and employment of women. Third, the similarity of the sampling standards of CHIPs2002 and CHIPs 2018 enabled the comparison of the results from two different points in time. However, this study is not a strict dynamic comparison study. The investigation of the dynamic change of parenthood effects is an emerging challenge which can be addressed in future research. Despite these limitations, we believe that the current study is the first to investigate the influence of parenthood on the gender wage gap based on decomposition methods, thereby providing new evidence on the association between family responsibility and motherhood wage penalty and its effects on the gender wage gap in urban China. It is also anticipated that the Chinese experience of motherhood wage penalty and the fatherhood wage premium resulting in the formation of the gender wage gap currently can provide valuable lessons for other countries.

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Declaration of Competing Interest

The author declares that has no competing interests.

Data availability

The authors do not have permission to share data.

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