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From fatherhood premium to motherhood penalty: trends in the fertility effects on men's and women's wage in China (1989–2015)

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Abstract

Investigating the impact of fertility on the wage earnings of men and women and its trends is important for understanding and coping with both the widening gender wage gap and the continuously declining fertility rate in China. Through an in-depth analysis of China Health and Nutrition Survey data from 1989 to 2015, the study finds that in the late 1980s, fertility had a significant positive impact on the wage earnings of men in China, while the negative impact on women's wages was not significant. Over time, the fatherhood wage premium has been declining, while the motherhood wage penalty has been rising at a faster rate, and the gender wage gap has been widening. The expansion of the market sector in China since the deepening of reforms in 1992 is an important reason for the rapid increase of motherhood wage penalty.

Keywords: Fatherhood premium, Motherhood penalty, Gender wage gap, Fertility

Introduction

Women have made significant progress in education and labor participation with the vigorous development of women's liberation movements worldwide over the past half-century. However, in many countries, the gender gap in income still exists and is even widening (Weichselbaumer and Winter-Ebmer 2005). Classic theories, such as human capital theory, gender segregation in occupation, and employment discrimination, attempt to explain the gender income gap in the field of paid work, but limited knowledge has been obtained (Blau and Kahn 2017). This background persuades many scholars to shift their focus from the workplace to the family and suggests that gender inequality in income is largely caused by the different roles of men and women (Lundberg and Rose 2000; Budig and England 2001). Traditional gender norms require women to devote more time and energy to child care when they have children, which sabotages their performance in the labor market and results in the "motherhood wage penalty". The income of men is not only immune to the negative influence of childbirth but also benefits from the "fatherhood wage premium" since the traditional family assigns the role of support to men and portrays them as hard workers. To date, many Western scholars have empirically demonstrated the different effects of fertility on the income of men and

women, but relevant research on China is scarce. The three factors below underline the significance and necessity of exploring this issue in the Chinese context.

First, China is deeply influenced by the ideas of patriarchal families, and the traditional gender norm of 'The man takes care of the outside and the woman takes care of the inside' (*nan zhu wai nv zhu nei*) has a profound impact on Chinese people (Liu and Tong 2014; Yang 2017). Given that the gender division of labor under the influence of traditional gender norms is the primary reason for the different impacts of fertility on the income of men and women, we expect that this gendered difference will be particularly prominent in the context of China. Therefore, studying the impact of fertility on the income of men and women in contemporary China is of great significance for understanding gender relations.

Second, since the establishment of the People's Republic of China, significant progress has been made in promoting gender equality. However, the gender gap in income has persisted and widened since the deepening of reform in 1992 (Li et al. 2014). There has been abundant discussion in academia with limited research explaining the existence and expansion of the gender income gap from the perspective of fertility. Therefore, addressing the impact of childbirth on the income of men and women can provide us with a new perspective on understanding gender inequality in income.

Finally, since the implementation of the family planning policy in the 1970s, China's fertility rate has rapidly declined (Guo 2008). Contrary to theoretical expectations, the decline in the fertility rate and the widening gender income gap have simultaneously occurred in China. It is generally believed that the decline in the fertility rate can help to alleviate work-family conflicts among women and narrow the gender income gap. However, in China, these two seemingly contradictory macro trends have occurred at the same time, implying some undiscovered changes in the impact of fertility on the income of men and women. Hence, exploring the complexity behind this contradictory phenomenon is of great significance for understanding the gender gap in income and the causes of low fertility.

Based on the above three points, we suggest that studying the impact of childbirth on the income of men and women in China is of great theoretical and practical significance. This article uses data from the China Health and Nutrition Survey (CHNS) from 1989 to 2015 to address these two questions: (1) what is the impact of childbirth on the income of men and women in China, and (2) how does this impact change over time? We will further the discussion of the causes of China's widening gender income gap and the decrease in the fertility rate in the past several decades and propose policy measures and suggestions.

Literature review

Overview of studies in Western countries

The impact of childbirth on the income of men and women is a hot topic in academia. A large number of studies in Western countries have found that after childbirth, women's income significantly decreases, that is, they face a "motherhood penalty"; however, there has been a moderate increase in men's income after childbirth, that is, they enjoy the "fatherhood premium". Taking the United States as an example, multiple research projects with different datasets show that every child can lead to a 5% to 20% decrease

in women's income (Budig and England 2001; Glauber 2007), but after becoming a parent, men's income increases by 3% to 10% (Lundberg and Rose 2000; Hodges and Budig 2010). Since fertility has a completely opposite impact on the wages of men and women, the gender gap in income rapidly expands after childbirth. In addition, the negative impact of fertility on women's income also reduces their fertility desire. In the context of the increasing education level and labor participation rate of women, an increasing number of women choose to have fewer or no children because of the work-family conflict caused by fertility (McDonald 2000).

In recent years, scholars in Western countries have increasingly focused on this issue since the impact of fertility on the income of men and women is of great significance for understanding the gender inequality of income and the causes of low fertility rates. Research has found that fertility affects the income of men and women in four ways. First, the theory of human capital accumulation suggests that women tend to discontinue their work or engage in part-time work due to family reasons after childbirth that will hinder their accumulation of human capital. However, men's human capital is rarely negatively affected by childbirth (Budig and England 2001). Second, the theory of job involvement suggests that after giving birth, women will mainly focus on taking care of their children, which will reduce their labor productivity and result in a decrease in their income. After having children, men will mainly focus on their work, and their labor productivity and income will increase (Killewald 2013). Third, the theory of compensating wage differential suggests that women with children tend to choose jobs that are more "friendly to mothers", such as flexible working hours and low physical exertion, which often have lower wages. Men with children usually do not have these concerns and even deliberately choose those with high labor intensity and difficult conditions to earn compensatory wages (Budig and England 2001). Fourth, the theory of employment discrimination suggests that employers will impose "statistical discrimination" on women with children based on experience or stereotypes. In contrast, employers not only rarely impose employment discrimination on fathers but also believe that men will obtain many excellent qualities after having children. Consequently, fathers receive better financial treatment due to social stereotypes (Correll et al. 2007).

In addition to identifying the different impacts of childbirth on the income of men and women, scholars in Western countries are currently advancing their research on this issue in two directions: first, to study whether the impact of childbirth on the income of men and women is heterogeneous among social groups, and second, to study whether this impact will change over time.

Regarding the first question, many studies have found that the impact of childbirth on the income of men and women is indeed significantly different among social groups with different socioeconomic and family characteristics. Taking the United States as an example, research has found that white and married mothers with young children face greater financial punishment (Budig and England 2001; Glauber 2007). For men, the financial premium mainly benefits married biological fathers living with children (Killewald 2013). Furthermore, from the perspective of socioeconomic characteristics, multiple studies have found that men's education level, professional status, and income are positively correlated with their fatherhood premium (Hodges and Budig 2010). For women, research findings are still controversial. Some studies have found that women

with lower income and lower education levels experience a significant decrease in their financial income after childbirth (England et al. 2016); however, other studies have found that women with higher education levels face a greater degree of financial punishment (Amuedo-Dorantes and Kimmel 2005).

Regarding the second question, existing research has found that the impact of childbirth on the income of men and women in wages varies over time, but the trend varies in different countries. Multiple studies in the US have found that the negative impact of childbirth on women's wages gradually weakens after the 1990s, while the positive impact of childbirth on male wages continues to increase (Glauber 2018). A study in Norway also found that the punitive effect of childbirth on female wages decreases over time, but the fatherhood premium does not show a significant change (Petersen et al. 2014). Moreover, a study in Germany and the UK found that the fatherhood premium decreases over time (Mari 2019).

Studies on China

Compared with the abundant research conducted in Western countries, research on China is still very limited. Only a few scholars have studied the impact of childbirth on women's income, but the estimated results obtained by different studies vary greatly. For example, Jia et al. (2013) used the CHNS data from 1991 to 2009 and found that the effect of childbirth can reduce women's hourly pay by 18%. With the same data, Yu and Xie (2014) found that childbirth has a punitive effect on women's hourly pay of only 7%, while Zhang (2011) found that this effect reaches 76%. The significant differences among these results may be due to different estimation methods. For instance, Jia et al. (2013) used the infertility odds ratio of couples in different age groups as the instrumental variable to estimate the impact of childbirth on women's income. Zhang (2011) used the gender of the first child as the instrument variable. Yu and Xie (2014) used a fixed effects model. Differences among these methods make the results incomparable. Moreover, these results cannot be compared with similar studies in other countries.

In addition to study the impact of childbirth on women's wages, some scholars have analyzed the heterogeneity of this impact. Some studies have found that childbirth has the greatest punitive effect on women's wages when women live with their parents-in-law, followed by when they live with their husbands. The negative impact becomes the smallest when women live with their own parents (Yu and Xie 2018). There are also studies that have found that having children has a greater negative impact on women who live in cities, who are receiving higher education, and who have a higher professional status (Yu and Xie 2014). However, existing research on the impact of working sectors has not reached consensus. Some studies have found that working in the private sector has a greater punishment effect on female employees (Jia and Dong 2013), while others have found that working in the public sector has a greater punishment effect on female employees (Yu and Xie 2014).

In brief, scholars have conducted many insightful explorations on the impact of childbirth on women's income and have obtained some preliminary research conclusions. However, existing research still has obvious shortcomings in the following three aspects. First, existing research only analyzes the impact of childbirth on women's income and neglects the impact on men's. However, according to relevant research in Western

countries, the impact of childbirth on the gender income gap between men and women is achieved through two channels: the motherhood penalty and the fatherhood premium. Family fertility decisions are also made by both husbands and wives. Therefore, the lack of an impact of childbirth on male income hinders the comprehensive study of the relationship between fertility and the gender income gap, as well as family fertility decision-making at the micro level and the causes of the sustained low fertility rate at the macro level.

Second, there are still controversies in existing research on some key issues. For example, it is not clear whether public sectors or private sectors have a greater punitive effect on women's income. Given that the expansion of China's private sectors since the reform and opening up has been an important factor leading to the widening income gap between men and women (He and Wu 2015), it is of great significance to distinguish the punitive effects of the public and private sectors on women's income to understand the relationship between market-oriented reform and the widening income gap between men and women.

Finally, existing research has not analyzed how the impact of childbirth on Chinese men's and women's wages changes over time. Since the reform and opening up in 1978, China has undergone rapid changes. Whether and how social change at the macro level affects the relationship between fertility and the income of men and women is worth inquiry. In the following sections, we briefly review the course of social change in China and theoretically analyze the impact of social change on the motherhood penalty and the fatherhood premium. Then, we will use CHNS data from 1989 to 2015 to test these theoretical hypotheses.

Social change and the impact of fertility on the income of men and women

Since the reform and opening up in 1978, Chinese society has undergone tremendous changes. In recent years, many theoretical studies on gender relations have focused on the impact of these social changes on gender equality (Ji et al. 2017). In this section, we explore how the impact of fertility on the income of men and women in China changes over time in the context of social change from the perspectives of danwei abolishment, the expansion of the private sector and the change in parenting with gender theory.

Danwei abolishment

During a long period of time before and after the reform and opening up, urban society in China was organized by danwei. For workers, danwei was not only a place of work but also an institution providing basic social welfare, such as childrearing, housing, and elderly care (Zheng 2008). Many government departments and danwei were equipped with nurseries or kindergartens providing almost free infant and child care services to employees with preschool children (Yue and Fan 2018). Although the service is not ample, it greatly alleviates the care burden of families, especially mothers' care work, and strongly supports couples in fully participating in paid work (Tong and Chen 2019).

However, over time, the drawbacks of the danwei system have gradually emerged. Many enterprises are even on the brink of bankruptcy due to excessive expenditures on social welfare services and poor management. To restore the vitality of the production and operation of danwei, the Chinese government carried out extensive reforms on

state-owned enterprises in the late 1990s, one key focus of which was to "reduce the burden" on enterprises and strip away the social welfare functions that were originally undertaken by danwei. In this context, the infant and child care services that were originally provided by government and enterprises have gradually been abolished. However, China has not yet established an effective infant and child care social system, leaving the care responsibility of preschool children to their families.

After the return of care responsibilities for infants and young children to their families, the pressure of child care on parents has increased unprecedentedly, which may have a negative impact on their work and income. Therefore, we hypothesize that after 1992, with the abolishment of danwei, the positive impact of childbirth on men's income will decrease, and the negative impact on women's income will become greater. In addition, given that mothers often need to bear more responsibilities in child caring, we hypothesize that the punitive effect of childbirth on women's income will increase at a faster rate than that on men's income.

The expansion of private sectors

In addition to the reform of the danwei system left from the planned economy period, another focus of China's economic reform is to establish the decisive role of the market in resource allocation and to establish and improve the socialist market economy system. As the market economy gradually replaces the planned economy, the nonpublic economy, such as individual, private, and foreign-invested units, is rapidly developing, and the proportion of urban labor in the employment of the private sectors is constantly expanding. Some studies have pointed out that the private sectors are completely profit-oriented, emphasizing competition and prioritizing efficiency, with less consideration of fairness. Therefore, private sectors are more likely to discriminate against female workers in terms of employment and financial rewards. However, the public sectors provide more employment protection for female workers and have done better in implementing gender equality and equal pay for equal work (Zhang et al. 2008). Therefore, many studies argue that the expansion of private sectors after market-oriented reform is an important cause of the continuous widening of the gender income gap (He and Wu 2015).

Although existing research suggests that the private sector is more likely to discriminate against women than the public sector, one question remains unclear: why does the private sector discriminate against women? Especially when the education level of women has already caught up with or even surpassed that of men, why do Chinese enterprises still treat women differently? We believe that this is closely related to the need for women to take on more care responsibilities after giving birth. According to research conducted in Western countries, women are more likely to experience career interruptions after giving birth and are more likely to be unable to devote all themselves to work due to caring for children (Budig and England 2001). This situation may be more common in a country with particularly strong traditional gender norms, such as China. Therefore, we argue that employers pay lower wages to female workers to actually punish the behavior of childbearing. Moreover, this punishment will be more pronounced in the profit-oriented private sector. With the advancement of China's market-oriented reform, more women have started to work in the private sector with severe motherhood penalties. Therefore, we hypothesize that the punitive effect of childbirth on women's

income continues to increase over time. For men, the impact of market-oriented reform is not significant, so the fatherhood premium will not change over time.

The change in parenting style

Finally, the social change in China since the reform and opening up is also reflected in the decline in the family fertility rate after the implementation of the family planning policy and the consequential changes in parenting style. In the late 1960s, China's total fertility rate was approximately 6. However, since the implementation of the family planning policy, China's fertility rate has rapidly declined (Guo 2008). In 2015, the unadjusted total fertility rate was only 1.05, much less than the worldwide recognized extremely low fertility rate of 1.3 (National Bureau of Statistics 2016).

Theoretically, with the reduction of childbirth, the parenting burden of parents will also be reduced. However, in China, this is not the case. Many studies have found that with the decrease in fertility, Chinese parents' attention has changed from quantity to quality, and the parenting style has also begun to develop from an "extensive" style to a "scientific" and "intensive" style (Zheng 2019). Specifically, the "scientific" and "intensive" style of parenting manifests in multiple aspects, such as arranging each meal for children; selecting suitable toys, clothing, and daily necessities; planning education at each stage in advance; and accompanying and participating in various extracurricular training activities (Jing 2017; Yang 2018). These activities not only cost a large amount of money but also, more importantly, consume much of the energy and time of parents. Therefore, with the mainstreaming of the "scientific" and "intensive" style of parenting, the burden of childrearing has become increasingly heavy. Against this background, mothers are likely to be the people who are affected most. Therefore, we expect that the punitive effect of childbirth on motherhood will become increasingly apparent over time. And fathers who used to play a supporting role in parenting are not immune. It can be expected that the fatherhood premium will gradually disappear.

In brief, the abolishment of the danwei system, the expansion of the private sector, and the change in parenting style can all lead to changes in the impact of childbirth on the income of men and women, and these three changes are more unfavorable for women. In recent years, some theoretical research on gender relations in China has noted that since the reform and opening up, gender inequality in the fields of work and family in China has intensified. For instance, Zuo and Jiang (2009) suggest that China's economic reform has resulted in a shift in the relationship between the state and families from "family-state integration" to "family-state separation". As the state continues to reduce its public services for families and reduce employment protection for women, gender inequality in both work and family has increased. Similarly, Song (2012) pointed out that China attempted to establish a public–private integrated structure during the planned economy period and provided many institutional measures to alleviate work-family conflicts among women (such as the childcare institutions provided by danwei). However, the collectivist production system consciously maintains the gender division of labor in the family, and this deliberate preservation foreshadows women's disadvantageous position in the labor market under the market-oriented reform. Moreover, Wu (2009) conducted an in-depth analysis of the transformation of the national gender discourse before and after the market-oriented reform. She points out that after the reform and opening

up, the discourse that emphasizes gender equality led by the state was replaced by the discourse that emphasizes free competition led by the market. Marketization not only transformed the narrative style and rhetoric of the national discourse but also engenders an alliance of market discourse and traditional discourse, in which the traditional gender norm of "the man takes care of the outside and the woman takes care of the inside" is once again rampant and gender norms and gender relationships are becoming more traditional and conservative. Finally, Ji et al. (2017) proposed a more comprehensive analytical framework based on previous research. They suggest that China's market-oriented reform has had two important impacts on gender relations. On the one hand, the abolishment of the danwei system has resulted in the separation of the public and private spheres, and the care responsibilities previously undertaken by danwei are marketized as well as gradually shifting to families and especially to women, which has increased the burden of women in the families, deteriorated their labor market status, and increased gender inequality. On the other hand, the degradation of gender equality ideology has led to a resurgence of traditional gender norms that justify the widening gender inequality in the fields of work and family.

We argue that the aforementioned theoretical observations on gender relations in China are in accordance with the basic view of this article. Although scholars have placed more emphasis on the negative impact of social change on women's labor market status and family status, this article also focuses on the negative impact of social change on men. The pressure of child care in the family has increased unprecedentedly, and the social expectations of fathers and fathers' participation in parenting have also undergone changes. Using survey data from Shanghai, Xu and Zhang (2007) found that men in Shanghai have a strong sense of responsibility and identification with their roles as fathers, and most wives are also satisfied with their husbands' participation in parenting. In addition, Xu and Wang (2019), using data from the China Education Panel Survey in 2014–2015, found that the percentages of fathers' participation in taking care of children's daily needs, helping with homework and learning, and accompanying children are so large that fathers' role in parenting should not be neglected. Drawing on these findings, we argue that the abolishment of the danwei system, the expansion of private sectors, and the changes in parenting style not only significantly increase the parenting burden of women, making them increasingly difficult to balance work and family but also involve men in caring for children and weaken the effect of fatherhood premiums. Considering that the responsibility for child rearing is still mainly borne by mothers, we argue that social change has a greater impact on women. Therefore, the punitive effect of childbearing on mothers' income will change faster.

Data, variables and estimation methods

Data

This study used CHNS data from 1989 to 2015. The CHNS is a large-scale national longitudinal survey jointly designed and conducted by the China Center for Disease Control and Prevention and the University of North Carolina in the United States. The survey was officially launched in 1989, and then nine rounds of panel surveys were conducted in 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011, and 2015 in 12 provinces/municipalities, including Heilongjiang, Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi,

Guizhou, Beijing, Shanghai and Chongqing. Compared with other surveys, the CHNS has significant advantages.

First, the CHNS is the earliest and longest panel survey project in China and therefore it can reflect China's social change well since the deepening of reform in 1992. Second, all members of the family were interviewed in the CHNS, so we can match couples for analysis, which greatly expands the scope of the variables. Finally, compared with cross-sectional data, the CHNS is a panel survey project with a significant advantage in inferring the causal relationship between variables.

Based on the research requirement, we have put four restrictions on CHNS data. First, given that marriage is the premise of fertility in China and that the probability of fertility of respondents over 50 years old is very small, we have limited the sample to married people aged 50 years and below. Second, to include the characteristics of both husbands and wives in the analysis, we further limited the sample to married couples who were both surveyed. Third, we removed respondents who did not report their income during the survey. Fourth, to use the fixed-effect model, we only retained respondents who had undergone two or more rounds of interviews. With the above restrictions, the final sample size for analysis was 4,887, including 2,909 males and 1,978 females.

Variables

There are two dependent variables in this study: the respondents' annual income and hourly income. Hourly income, also known as wage rate, can be obtained by dividing monthly income by monthly working hours. Given that incomes in different years are not comparable due to inflation, we adjusted the income using the constant prices in 2015. In addition, considering that many independent variables have a linear relationship with the logarithm of income, we performed log transformations on these two dependent variables.

The primary independent variable of the analysis is the number of surviving children of the respondents. The CHNS inquires in detail about the fertility history of married women, and the number of surviving children of the female sample can be directly obtained from the data. For the male sample, we used the number of surviving children given by their spouse as the independent variable.

In addition, we also included three groups of time-varying control variables. The first group is the occupational characteristics of the interviewee and their spouse, including monthly work hours, occupational type, working sector, and whether they had part-time jobs. The second group is the family characteristics of the interviewee and their spouse, including the time spent on household chores and child care, as well as whether they live with their parents and parents-in-law. The third group of control variables are variables related to age and time, including age, the square of age, and the year of survey.

Statistical model

The statistical model used in this study is the fixed-effect model. Compared with other statistical models, such as multiple linear regression, the fixed-effect model can control all individual characteristics that do not change over time, and hence, it can effectively avoid "omitted-variable bias" at the individual level. Taking this study as an example,

for individual i at any survey time t, the logarithm of their income $ln(wage)_{it}$ can be expressed as follows:

$$ln(wage)_{it} = \beta_1 birth_{it} + \beta_2 (job\ controls)_{it} + \beta_3 (family\ controls)_{it} + \beta_4 (other\ controls)_{it} + \alpha_i + \varepsilon_{it}$$

In this equation, the number of surviving children ($birth_{it}$) is the primary independent variable, and β_1 is its regression coefficient. To obtain a consistent estimation of β_1, we control the occupational characteristics, family characteristics, and other characteristics that can change over time in the model, and their effects on the dependent variable are shown as β_2, β_3, and β_4. In addition, the model also includes i fixed coefficients α_i to represent the impact of individual characteristics that do not change over time on the dependent variable. The influence of individual characteristics that change over time and are not included in the model is represented by the error term ε_{it}.

To obtain the fixed-effect estimates, we can first calculate the mean of each variable for each individual and then calculate the mean differences of each variable from their individual mean. Since α_i does not change over time, it will be eliminated from the equation. Therefore, the fixed-effect model can eliminate the interference of all individual characteristics that do not change over time on the estimation of β_1. With this advantage, the fixed effects model has become the most commonly used statistical method worldwide to study the impact of fertility on the income of men and women.

Results

The impact of childbirth on the income of men and women

Table 1 shows the descriptive statistics of all variables by gender and fertility. In this table, it can be seen that the average annual wage of men who have children is 18,000 yuan, and the hourly wage is 109.9 yuan, which are 2000 yuan and 19.4 yuan higher than those who do not have children, respectively. For women, the average annual wage of those who have children is 5000 yuan lower than that of women who do not have children. In addition, their hourly wage is 24.1 yuan lower than that of their childless counterparts. Therefore, through a simple statistical description, women suffer from the motherhood penalty, while men enjoy a fatherhood premium. However, Table 1 also shows that there are significant differences in occupational characteristics, family characteristics, and other characteristics between the fertile and nonfertile samples. Coupled with unobserved individual characteristics that may cause bias, we cannot obtain the causal effect of childbirth on the income of men and women in China from Table 1 alone.

To obtain the causal effect of childbirth on the income of men and women, we use the fixed effect model. The results for men are shown in Table 2, and the results for women are shown in Table 3.

In Table 2, it can be seen that after controlling the occupational characteristics, family characteristics, other characteristics, and all individual characteristics that do not change over time, childbirth only has a rather weak positive impact on men's income. Regardless of whether we use the logarithm of annual wages or the logarithm of hourly wages as the dependent variable and whether the number of children is included as a continuous variable or categorical variable, the impact of childbirth on men's income is

Table 1 Descriptive statistics of all variables by gender and fertility

	Male		**female**	
	Have no child	**Have children**	**Have no child**	**Have children**
Annual wage (10,000 yuan)	1.6	1.8	2.0	1.5
	(1.9)	(3.6)	(6.5)	(3.5)
Hourly wage (yuan)	90.5	109.9	111.0	86.9
	(117.9)	(323.8)	(377.2)	(238.9)
Number of children (person)	–	1.5	–	1.3
	–	(0.8)	–	(0.6)
Number of children (%)				
One	–	61.5	–	73.4
Two	–	28.0	–	22.1
Three and more	–	10.5	–	4.5
Age (years old)	31.2	38.4	29.2	36.5
	(7.5)	(6.9)	(7.2)	(6.6)
Occupation (%)				
Professionals or managers	18.0	27.4	27.8	25.1
Services personnel	25.1	21.5	40.1	31.2
Farmer	5.0	8.8	0.4	4.5
Worker	44.5	37.6	28.2	35.4
Others	7.4	4.7	3.5	3.9
Work time (hours/month)	197.6	199.0	200.0	195.9
	(51.2)	(57.2)	(42.8)	(50.7)
Work sector (%)				
Public	79.4	76.8	80.6	77.2
Market	20.7	23.2	19.4	22.8
Have a second job (%)				
No	92.6	86.9	96.5	93.5
Yes	7.4	13.1	3.5	6.5
Spouse's occupation (%)				
Professionals or managers	18.6	15.4	21.6	29.1
Services personnel	24.5	21.7	26.4	22.1
Farmer	11.2	20.5	3.5	5.7
Worker	23.3	22.3	33.5	32.9
Others	5.3	4.4	8.4	5.6
Unemployment	17.1	15.7	6.6	4.7
Spouse's work sector (%)				
Public	68.4	62.0	71.8	73.8
Market	14.5	22.4	21.6	21.6
Unemployment	17.1	15.7	6.6	4.7
Spouse has a second job (%)				
No	96.2	95.2	98.7	93.5
Yes	3.8	4.8	1.3	6.5
housework time (hours/day)	0.5	0.8	1.3	2.7
	(0.8)	(1.5)	(1.0)	(2.5)
Spouse's housework time (hours/day)	1.5	3.2	0.6	1.0
	(1.3)	(3.1)	(0.9)	(1.7)
Coreside with parents (%)				
No	95.8	74.0	97.8	95.7
Yes	4.2	26.0	2.2	4.3

Table 1 (continued)

	Male		female	
	Have no child	**Have children**	**Have no child**	**Have children**
Coreside with spouse's parents (%)				
No	95.0	96.1	44.1	70.9
Yes	5.0	3.9	56.0	29.2
Missing of housework time (%)				
No	87.9	85.9	89.9	88.9
Yes	12.1	14.1	10.1	11.1
Missing of spouse's housework time (%)				
No	91.7	89.5	85.9	86.7
Yes	8.3	10.5	14.1	13.4
Survey year (%)				
1989	15.9	12.9	14.1	11.9
1991	12.1	13.1	11.5	12.9
1993	7.4	11.9	8.8	11.9
1997	13.0	9.5	10.1	9.3
2000	10.9	10.4	5.3	10.1
2004	6.5	7.0	8.4	7.0
2006	7.4	8.6	7.9	8.0
2009	7.4	8.7	7.9	8.5
2011	12.1	10.5	15.4	11.6
2015	7.4	7.4	10.6	8.8
Person-years	339	8767	227	5812

For continuous variable, standard deviation is given in parentheses

Table 2 The impact of childbirth on male's wage

	Annual wage		Hourly wage	
	Model 1	**Model 2**	**Model 3**	**Model 4**
Number of children	0.050		0.039	
	(0.033)		(0.034)	
Number of children (none = 0)				
One		0.080		0.073
		(0.057)		(0.059)
Two		0.147		0.152
		(0.076)		(0.078)
Three and more		0.110		0.014
		(0.129)		(0.132)
Control variables	Yes	Yes	Yes	Yes
Intercept	6.668***	6.674***	2.881**	2.902**
	(0.949)	(0.950)	(0.971)	(0.972)
R-squared	0.391	0.391	0.455	0.455
Number of respondents	2909	2909	2909	2909
Person-years	9106	9106	9106	9106

All control variables are included in models; for space limitation control variables' coefficients are not reported

**$p < 0.01$; ***$p < 0.001$

Table 3 The impact of childbirth on women's wage

	Annual wage		Hourly wage	
	Model 5	**Model 6**	**Model 7**	**Model 8**
Number of children	−0.170***		−0.174***	
	(0.051)		(0.052)	
Number of children (none = 0)				
One		−0.036		−0.038
		(0.076)		(0.078)
Two		−0.258*		−0.269*
		(0.105)		(0.109)
Three and more		−0.875***		−0.860***
		(0.233)		(0.240)
Control variables	Yes	Yes	Yes	Yes
Intercept	4.771***	4.779***	1.642	1.652
	(0.996)	(0.996)	(1.027)	(1.026)
R-squared	0.389	0.390	0.447	0.448
Number of respondents	1978	1978	1978	1978
Person-years	6039	6039	6039	6039

All control variables are included in models; for space limitation control variables' coefficients are not reported

*$p < 0.05$; ***$p < 0.001$

not statistically significant. Based on this result, we can conclude that in the 26 years from 1989 to 2015, childbirth on average had no significant impact on men's income.

However, the results for women in Table 3 show that after controlling for all variables, the negative impact of childbirth on women's income is rather significant. It shows that the impact of each child born will lead to a 17.0% decrease in women's annual wages and a 17.4% decrease in their hourly wages. The negative impact of childbirth on women's income is mainly manifested in the birth of second child and above. Compared with childless women, the impact of having one child will cause a 4% decrease in women's annual and hourly wages, and this decrease is not statistically significant. However, after giving birth to a second child, the decreases in women's annual and hourly wages are 25.8% and 26.9%, respectively. After giving birth to a third or even more children, the decreases in women's annual and hourly wages are 87.5% and 86.0%, respectively. It can be concluded that childbearing (especially having more than one child) will have a rather significant negative impact on the wage income of Chinese women, which is significantly different from the weak positive impact of childbirth on Chinese men.

The time-varying effect of childbirth on the income of men and women

Tables 2 and 3 demonstrate that childbirth has a significant punitive effect on the wages of Chinese women, but the premium effect of childbirth on male wages is not significant. However, the above analyses only show the average effects of childbirth on the wage income of Chinese men and women between 1989 and 2015. It is worth further exploring whether and how these effects change over time.

The aforementioned theoretical analysis argues that with the abolishment of the danwei system, the expansion of the private sector, and changes in parenting style, the positive effect of childbirth on male wages in China will gradually disappear, and the negative effect on female wages will continue to increase. To verify this hypothesis,

we adopted two strategies to analyze the changing effect of the number of children over time. The first strategy includes the survey year in the model as a categorical variable (marked as discrete trend in Tables 4 and 5). The advantage of this strategy is that there is no parametric constraint of the time trend (such as linear decline or rise), while its drawback is that it needs to include multiple interaction terms of the survey year and the number of children and estimate multiple coefficients. Due to the limited sample size in each survey year, the estimated coefficients will suffer from fluctuation to some extent. The second strategy is to include the survey year as a continuous variable (marked as linear trend in Tables 4 and 5). The advantage of this strategy is that only one interaction term needs to be included, but its drawback is that the linear

Table 4 The time varying effect of childbirth on men's wage income

	Annual wage		**Hourly wage**	
	Discrete trend	**Linear trend**	**Discrete trend**	**Linear trend**
Number of children		0.144***		0.131**
		(0.040)		(0.041)
Number of children *(survey year -1989)		−0.008***		−0.008***
		(0.002)		(0.002)
Number of children				
1989	0.137**		0.125**	
	(0.042)		(0.043)	
1991	0.130**		0.104*	
	(0.042)		(0.043)	
1993	0.111**		0.109*	
	(0.043)		(0.044)	
1997	0.075 +		0.069	
	(0.042)		(0.043)	
2000	0.035		0.029	
	(0.043)		(0.044)	
2004	0.071		0.066	
	(0.051)		(0.052)	
2006	0.007		−0.005	
	(0.047)		(0.049)	
2009	−0.028		−0.046	
	(0.050)		(0.051)	
2011	−0.111*		−0.129*	
	(0.052)		(0.053)	
2015	0.008		−0.003	
	(0.062)		(0.063)	
Control variables	Yes	Yes	Yes	Yes
Intercept	7.337***	7.100***	3.549***	3.289***
	(0.960)	(0.947)	(0.983)	(0.970)
R-squared	0.396	0.393	0.459	0.457
Number of respondents	2909	2909	2909	2909
Person-years	9106	9106	9106	9106

All control variables are included in models; for space limitation control variables' coefficients are not reported

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 5 The time varying effect of childbirth on women's wage income

	Annual wage		Hourly wage	
	Discrete trend	**Linear trend**	**Discrete trend**	线性趋势
Number of children		−0.008		−0.020
		(0.062)		(0.064)
Number of children *(survey year -1989)		−0.013***		−0.013***
		(0.003)		(0.003)
Number of children				
1989	−0.056		−0.068	
	(0.065)		(0.067)	
1991	−0.074		−0.081	
	(0.065)		(0.067)	
1993	−0.104		−0.111	
	(0.065)		(0.067)	
1997	−0.050		−0.046	
	(0.065)		(0.067)	
2000	−0.087		−0.091	
	(0.070)		(0.072)	
2004	−0.224**		−0.240**	
	(0.076)		(0.078)	
2006	−0.343***		−0.355***	
	(0.072)		(0.074)	
2009	−0.445***		−0.434***	
	(0.073)		(0.076)	
2011	−0.360***		−0.330***	
	(0.072)		(0.074)	
2015	−0.240**		−0.238**	
	(0.081)		(0.084)	
Control variables	Yes	Yes	Yes	Yes
Intercept	6.030***	5.463***	2.807**	2.289*
	(1.007)	(0.994)	(1.039)	(1.024)
R-squared	0.402	0.392	0.458	0.450
Number of respondents	1978	1978	1978	1978
Person-years	6039	6039	6039	6039

All control variables are included in models; for space limitation control variables' coefficients are not reported

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

assumption is imposed, that is, the impact of fertility increases or decreases linearly over time.

To robustly analyze the effect of childbirth on the income of men and women over time, we report the results using both strategies. Table 4 shows that if we include the survey year as a categorical variable, the effect of the number of children on the wages of men was significantly positive before 2000. However, the positive effect decreases gradually over time and becomes no longer significant after 2000, and ultimately, a certain amount of negative effect emerges after 2009. If analyzing this changing effect with a linear trend, we find that the positive effect of childbirth on male wages in China was approximately 13% in 1989, but this effect decreased at a rate of 0.008 per year. Therefore, the effect decreased to 0 in approximately 2007 and then gradually changed from

positive to negative. This process of gradually changing from positive to zero and finally to negative results in an insignificant effect of childbirth on the wage income of Chinese men in Table 2.

The analysis for female samples shows that the negative effect of childbirth on the wages of Chinese women was rather limited before 2000 and not statistically significant. However, the negative effect of childbirth continues to increase and becomes significant after 2000. If a linear trend is imposed to describe this process, it can be found that from 1989 to 2015, the negative effect of childbirth on women's wages increased by an average of 0.013 per year. Therefore, by 2015, the punitive effect of childbirth on female wages reached approximately 35%.

The expansion of the private sector and its influence

In summary, from 1989 to 2015, the impact of childbirth on the wages of men and women in China underwent significant changes. We argue that the abolishment of the danwei system, the expansion of the private sector, and changes in parenting style are the three primary factors for these changes. Because the impact of the abolishment of the danwei system and changes in parenting style cannot be verified using CHNS data, we focus on examining the impact of the expansion of the private sector in this section.

Table 6 shows that from 1989 to 2015, the proportion of men and women employed in the private sector in the CHNS data continued to rise. In 1989, the percentages of men and women employed in the private sector were only 3.3% and 3.5%, but by 2015, the percentages had risen to 52.2% and 51.5%. Does this increase lead to a change in the effect of childbirth on the wage income of men and women?

To answer this question, we compared the effect of childbirth on male and female wages between the private sector and public sector. Table 7 shows that for men, the interaction term between number of children and private sector is not significant. However, for women, the difference between the private sector and the public sector is quite significant. In the public sector, women's annual and hourly wages decrease by 12.2% and 12.7%, respectively, with each child born on average, while in the private sector, the punitive effect of childbirth on women's annual wages and hourly wages is 29.1% and 29.3%, respectively. Since the private sector imposes a greater penalty on women having children, the motherhood penalty will become stronger with the expansion of the private sector in China since the market-oriented reform. However, for men, the difference between working in the private sector and the public sector is not significant, and thus, the expansion of the private sector does not result in a significant change in the impact of childbirth on their wage.

To clarify the extent to which the expansion of the private sector can explain the changing effect of childbirth on the wages of men and women over time, we include the interaction term of the private sector and the number of children in the models of

Table 6 Percentages of employment in the private sector by gender and the survey year

	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Male	3.3	2.9	2.5	3.3	4.2	37.1	50.8	54.6	54.0	52.2
Female	3.5	3.3	2.1	3.0	5.9	33.6	46.0	51.4	48.9	51.5

Table 7 The impact of childbirth on the wage of men and women in different work sectors

	Annual wage		Hourly wage	
	Male	**Female**	**Male**	**Female**
Number of children	0.063	−0.122*	0.053	−0.127*
	(0.034)	(0.052)	(0.035)	(0.054)
Market sector	−0.071	0.117	−0.041	0.148*
	(0.055)	(0.067)	(0.056)	(0.069)
Number of children * market sector	−0.051	−0.169***	−0.052	−0.166***
	(0.031)	(0.046)	(0.032)	(0.047)
Control variables	Yes	Yes	Yes	Yes
Intercept	6.945***	5.353***	3.137**	2.183*
	(0.948)	(0.994)	(0.971)	(1.025)
R-squared	0.391	0.391	0.455	0.449
Number of respondents	2909	1978	2909	1978
Person-years	9106	6039	9106	6039

All control variables are included in models; for space limitation control variables' coefficients are not reported

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 8 Market expansion and the changing effect of childbirth on the wage of men and women

	Annual wage		Hourly wage	
	Male	**Female**	**Male**	**Female**
Number of children	0.144***	−0.012	0.131**	−0.024
	(0.040)	(0.062)	(0.041)	(0.064)
Market sector	−0.154**	0.034	−0.121*	0.070
	(0.059)	(0.072)	(0.060)	(0.074)
Survey year-1989	0.075*	0.026	0.085*	0.054
	(0.034)	(0.038)	(0.035)	(0.040)
Number of children * market sector	0.009	−0.102*	0.006	−0.103*
	(0.035)	(0.050)	(0.035)	(0.052)
Number of children *(survey year-1989)	−0.008***	−0.010**	−0.008***	−0.010**
	(0.002)	(0.003)	(0.002)	(0.003)
Control variables	Yes	Yes	Yes	Yes
intercept	7.110***	5.420***	3.296***	2.246*
	(0.948)	(0.993)	(0.970)	(1.024)
R-squared	0.393	0.392	0.457	0.450
Number of respondents	2909	1978	2909	1978
Person-years	9106	6039	9106	6039

All control variables are included in models; for space limitation control variables' coefficients are not reported

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Tables 4 and 5. The results are shown in Table 8. Comparing the results in Tables 4, 5, and 8, we find that for the male sample, adding the interaction term of the number of children and the private sector does not change the coefficient of the interaction term of the number of children and the survey year. Therefore, the expansion of the private sector cannot explain the decreasing trend of the fatherhood premium on men. However, the analysis for the female sample shows that after adding the interaction term of the number of children and the private sector, the coefficient of the interaction term of the number of children and the survey year increased from − 0.013 to − 0.010, and hence,

the rate of change decreased by 0.003. This indicates that some portion (approximately 23.1%) of the increase in the motherhood penalty can be explained by the expansion of the private sector. In addition, with the interaction term of the number of children and the private sector, the difference in the speed of change between fatherhood premium and motherhood penalty also decreased from 0.005 to 0.002, indicating that approximately 60% of the trend of the widening gap between men and women's wages after childbirth can be explained by the expansion of the private sector.

Conclusion and discussion

This study explores the impact of childbirth on the wages of men and women in China and its trend over time using CHNS data from 1989 to 2015. We find that in the late 1980s, childbirth had a significant positive effect on the wages of men in China, and the punitive effect on women's income was rather limited, approximating zero. The fatherhood premium for men continues to decrease, while the motherhood penalty on women increases at a faster rate over time, leading to a widening wage gap between men and women. The expansion of the private sector in China since the deepening of reforms in 1992 is a vital reason for the rapid increase in the motherhood penalty over time. The results show that the punitive effect of childbirth on women's wages is more evident in the private sector. The proportion of workers employed in the private sector has rapidly increased over time, leading to a rapid increase in the motherhood penalty. The wage gap between men and women continues to widen after childbirth.

The above research findings demonstrate that the motherhood penalty and fatherhood premium are two critical factors that affect the gender wage gap over time. In the late 1980s, large-scale market-oriented reforms in Chinese cities had not yet launched, and the danwei system was still stable. The vast majority of government agencies and enterprises provided parenting services to their workers. In addition, the concepts of "scientific parenting" and "intensive parenting" had not yet been popular, so and the burden on families of raising children was relatively low. In this context, childbirth did not have a significant negative impact on women's wages. Although the wage gap between men and women still existed, the gap was not large enough, and this gap was mainly caused by the fatherhood premium.

However, with the deepening of reforms in 1992, China's danwei system began to collapse, and the free parenting services provided by danwei in the past gradually disappeared. Meanwhile, with the expansion of the private sector in the entire national economy, it becomes more difficult for women to balance work and family. In addition, the concept of "scientific parenting" and "intensive parenting" has gradually become a social trend, and hence, the burden of childbirth on families has become increasingly heavy. In this context, the impact of childbirth on the wages of men and women has begun to show significant changes. For men, the premium effect of childbirth on wages has gradually disappeared. For women, the punitive effect for childbirth has become increasingly significant. Moreover, due to traditional gender norms, women have to bear more parenting responsibilities after childbirth, so the punitive effect of childbirth on their wages is changing at a faster rate, leading to a widening gap between men and women. Over time, the motherhood penalty has gradually replaced the fatherhood premium as the primary factor in the gender wage gap.

In conclusion, the findings of this study demonstrate the theoretical observations of scholars on gender relations in China (Ji et al. 2017). With the abolishment of the danwei system, expansion of the private sector, and changing norms in parenting, China's public and private spheres have become separated, and women's burden of caring for children has unprecedentedly increased. In addition, gender discourse and norms have demonstrated a trend of returning to tradition, which has greatly damaged women's labor market status and resulted in an increasingly severe motherhood penalty.

At the same time, this study also introduces the male perspective that has been largely neglected in previous gender studies and finds that in the process of dramatic social change, the positive impact of fertility on males' wages has also tended to disappear. This finding helps us to understand why the wage gap between men and women in China continues to expand and why the fertility rate continues to be low. We suggest that the abolishment of the danwei system and the popularity of intensive parenting are two important factors that have led to the disappearance of the fatherhood premium. In the context of the return of child-rearing responsibilities to families and the increasing economic and time costs of parenting, men are no longer completely free from care work and have to share some of it, which has made it difficult for them to enjoy the dividend of childbirth as in the past. In recent years, some investigations on fathers' participation in parenting have found that the degree of fathers' parenting in China has gradually increased over time (Xu and Zhang 2007; Xu and Wang 2019). This provides support for the viewpoint of this study to some extent. However, due to the limitations of CHNS data, we currently cannot conduct a thorough analysis on the causal mechanism of the disappearance of the fatherhood premium, which is also a limitation of this study and a question worth exploring with available data.

In addition, the findings of this study also help us to understand the coexistence of seemingly contradictory macro phenomena of declining fertility rates and widening gender wage gaps in China. It is generally believed that the decline in the fertility rate helps to alleviate work-family conflicts among women and reduce the gender wage gap. However, there are two implicit assumptions behind this statement. First, this statement assumes that the cost of caring for one child does not change with the decrease in the number of children, which is too idealistic. In fact, as the number of births decreases, the investment in each child rapidly increases; that is, there is a substitution relationship between child quality and quantity, as described by Becker (1991). In China, a typical manifestation of this substitution relationship is that with the decrease in the fertility rate, the parenting style begins to shift from "extensive" to "intensive". As a result, although the number of births has decreased, the burden of raising each child has actually increased. Every additional child thus has a greater negative impact on women's wages.

Second, the above statement assumes that the macro environment of society has not undergone significant changes during the process of declining fertility because if the macro environment undergoes significant changes, other factors may simultaneously affect fertility and the gender wage gap, leading to statistically spurious correlations. In the context of China, the abolishment of the danwei system and the expansion of the private sector are two significant macrolevel changes that cannot be ignored. The previous sections of this article discussed in detail how the changes in

these two factors have led to the widening gap between men and women in terms of wages. In fact, these changes also have a significant impact on the decline in the fertility rate. After the abolishment of the danwei system, the childcare work originally undertaken by the danwei was transferred to the family, which led to a significant increase in the cost of care for families and a decrease in families' willingness to have children. Market-oriented reform also has similar effects, since working in the private sector increases the difficulty for women to balance their work and family, leading to a decrease in fertility. In sum, the abolishment of the danwei system and the expansion of the private sector not only lead to an increase in the gender wage gap but also cause a decrease in the fertility rate. To a certain extent, it can be said that these two factors (and possibly other factors that were not considered) jointly contributed to the coexistence of a decline in the fertility rate and the widening gender wage gap.

Finally, the findings of this study also help us to understand the problem of low fertility in China. With the fatherhood premium gradually disappearing and the motherhood penalty continuing to increase, the willingness to have children decreases for both men and women. From this perspective, China's low fertility rate that has persisted for many years since the 1990s is closely related to the disappearance of fatherhood premiums and the aggravation of the motherhood penalty. China introduced the "two-child policy for couples where either the husband or the wife is from a single-child family" In 2013, and a more relaxed "universal two-child policy" in 2015. However, the rebound in fertility rates after the implementation of these two policies has been much lower than expected, which to some extent indicates that the adjustment of the fertility policy alone cannot fundamentally reverse the trend of the continuous decline in the fertility rate in China. Along with the adjustment of the fertility policy, proactive employment and family policies should be introduced to alleviate the increasingly heavy burden of having children and reduce the negative impact of having children on women's wages. This is of great importance for improving the fertility willingness of families and the overall fertility level of society. Given that the motherhood penalty is the main reason for the gender wage gap and the low willingness of families to have children at present, we suggest that more attention should be given to women, especially those working in the private sector. To alleviate the increasing work-family conflicts faced by women, it is vital to study how to protect women's legitimate rights and interests at the institutional level and to advocate gender equality through proactive guidance of public opinion.

Abbreviation
CHNS China Health and Nutrition Survey

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Declarations

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