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Xinxin Ma

Female Employment and Gender Gaps in China

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To my family and friends

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Tokyo, Japan Xinxin Ma
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Dr. Xinxin Ma is a professor at the Faculty of Economics, Hosei University. She was a council member of the Japanese Association for Chinese Economy and Management Studies (JACEMS) and was the editor of the Japanese Journal of Comparative Economics, Asian Studies, and the Journal of Chinese Economic. Her current research project focuses on economic transition and labor market segmentation in China, the gender gap of intrahousehold bargaining power and well-being, social security reform, and income inequality in China. Her articles have appeared in peer-reviewed journals such as *China Economic Review*, *Journal of Chinese Economic and Business Studies*, *Post-Communist Economies*, *Journal of Economic and Business*, *Emerging Markets Finance and Trade*, and the *Journal of Happiness Studies*. Her recent book is *Economic Transition and Labor Market Reform in China* (Singapore: Palgrave Macmillan 2018).

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Chapter 1
Introduction

1.1 Background and Aim of This Book

The level of economic development, economic policies and systems have been transformed since 1949 when the People's Republic of China was established. Economic historians usually divide the Chinese economy into the planned economy period (1949–1977), and the market-oriented economy reform period (post-1978) (also be called as "transition period"). In the period of planned economy, with the "socialism campion", the ownership of whole firms was changed into the government owned including the state-owned enterprises (SOEs), and collectively owned enterprises (COEs). In other words, only public sector maintained in the planned economy period in China. Based on the socialism ideology, Chinese government emphasized gender equality as an important socialist ideology, and the government enforced it thoroughly by implementing equal employment policies and policies to promote women's labor participation, as demonstrated by the slogan "women can hold up half of the sky". Therefore, the gender gap in employment, wages, and occupation was much smaller in that era (Meng 2000; Gustafsson and Li 2000; Li and Song 2013; Ma 2018a, b).

During the market-oriented economy reform period since the 1978, the influence of market mechanism has become greater which enhance the Chinese economic growth (Lin et al. 1994). As the progressive of economy transition and economic growth, the female employment and gender gap change greatly in China, the main reasons can be considered as follows.

First, with the progressive of ownership reform, the problem of administration against women in labor market has become severe (Gustafsson and Li 2000; Liu et al. 2000; Maurer-Fazio and Hughes 2002; Ma 2018a, b). China has long been known for its persistent advocacy for gradual economic reform. During the market-oriented economy reform period since 1978, reform has led to substantial growth of the private sector (i.e. privately owned enterprises: POEs; foreign owned enterprises: FOEs), while Chinese government has tried to preserve and give favorable treatment to the public sector (in particular, SOEs in key industry sectors) (Lin et al. 1994; Ma

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2018b, 2019; Ma and Iwasaki 2021; Iwasaki and Ma 2020). As a result, the division between the public sector and the private sector has become one of the most prominent features in Chinese labor market (Zhang and Xue 2008; Ye et al. 2011; Ma 2018a, b, 2019). Firms in the private sector can determine wage levels and employment conditions of individual workers at their own discretion. As it is pointed out by the discrimination hypothesis (Becker 1957), the discriminations against female workers from employer, customer or colleague may occur in the private sector. In additions, with the progressive of SOEs reform, the SOEs own more decision authorities of employees' employment and wage, the discrimination against female workers may occur easily than that in the planned economy period.

Second, from labor supply perspective, as the economic growth, the household income increased greatly in China (Li et al. 2017; Sicular et al. 2020). Based on individual utility maximum model, the increased household income may decrease the female labor force participation, a part of women in high-income household may choice to exit labor market to become housewives voluntarily (Fu et al. 2016; Ma 2018b; Ma and Zhang 2018).

Third, from the labor demand side, excepting the discrimination factors in workplace, it is found that as the development of industry sectors (i.e. service industry) and AI (*artificial intelligence*) technological progressive, the demand of female workers has changed greatly for both developed and developing countries (Goldin 1990; Wamboye et al. 2015; Gupta et al. 2015). With the progressive of modernization and urbanization in China, it can be assumed that the industry structural upgradation also effects female employment and gender gap in China.

Forth, the policy and institutional reforms also affect the female employment and wage gap in China. For example, the New Rural Pension scheme (NRPS) was implemented in 2009 in rural China, it is expected that receiving public pension benefits may enhance the well-being of individuals at older age, while it might also affect the labor supply of pensioner or intra-household prime-age adults (Cheng 2014; Zhang 2015; Liu et al. 2016; Liu 2017; Ma 2020). In additions, the Higher Education Expansion Policy (HEEP) was published in 1999, it might affect the college enrollment of students, employment and wage of college graduates (He 2009; Wu and Zhao 2010; Xing and Li 2011; Yao et al. 2014). When there maintains the gender role segregation in household and workplace, the influences of these policy or institutional changes on employment and wage may differ by gender.

Fifth, the gender role consciousness may change with the economy system transition and economic development, which may also affect the female employment and gender gap in China. Because there remains gender role segregation, the hours allocation of family care (i.e. parent care, child care), housework and market work differ by gender (Becker 1985). In China the influences of Confucian culture on the consciousness (i.e. filial piety, male domination of women) and lifestyle (i.e. parent care, living arrangement) are still maintain, particularly, which may cause to the different pictures of female employment and housework by areas.

These reasons mentioned above have made the female employment and gender gap changed greatly. This book aims to investigate the situations and determinants of female employment and gender gap in labor market under the market-oriented

economy reform period in China. It provides the reader with academic evidences for understanding the mechanism of female labor force participation, the determinants of gender gap in both household and workplace, and the impact of policy transformation on women' wage and employment in China from economics perspective.

1.2 Main Contents of This Book

This book consists of three parts—Part I Women's Family Responsibilities and Employment in China (Chaps. 2 and 3), Part II The Gender Gap in China's Labor Market and Society (Chaps. 4, 5 and 6) and Part III Impact of Policy on Women's Labor Market Outcomes in China (Chap. 7). The main contents of each chapter are as follows.

Chapter 2 analyzes the impact of market wage, reservation wage, and unearned income on the probability of work participation of married women by using the longitudinal survey data (China Health and Nutrition Survey: CHNS) from 1989 to 2015 and a random effects probit model to address the heterogeneity problem. The main findings can be summarized as follows: first, in general, the market wage positively affects the probability of work participation of married women; the reservation wage negatively affects the probability of work participation of married women; but the effect of unearned income is not statistically significant, which contrasts with most studies of developed countries. Second, the effects differ by age group: the market wage has a negative effect for middle-aged married women aged 40–49, while it has a positive effect for younger married women aged 20–39. The negative effect of child care is greater for mothers aged 30–39; the effect of a husband's income is not significant in any age group. Third, the effects differ by urban/rural area: the market wage positively affects the work participation of married women in urban areas, while the influence of the market wage on married women is not significant in rural areas. The negative effect of the reservation wage is greater for married women in urban areas than for those in rural areas; the effects of a husband's income are not significant for either urban or rural areas. Fourth, for the effects by employment status, the market wage positively affects the probability of becoming a regular worker; when the market wage rises, the probability of becoming an irregular worker is lower than that of becoming a nonworker. The negative effect of the reservation wage is greater for regular work. A husband's income positively affects the probability of a woman becoming a regular worker, while it negatively affects her probability of becoming an irregular worker. These results suggest that a child care support policy can be expected to address the family-work conflict for Chinese married women.

Chapter 3 investigates the impact of parent care giving on middle-aged women' employment in China. Based on the household utility maximum mechanism, most women assume family responsibilities, while most men work in the labor market. Therefore, it can be thought that parent care may affect women's labor supply. Some previous studies for developed countries found that parent care can decrease women's labor supply. Family care work—including parent care—has been considered a kind

of unpaid work in the household. China has become an aging-population society; the Chinese government has faced the problem of decreasing working-age laborers. Does parent care influence women's participation in work? Even though some previous studies have analyzed the influence of child care on women's labor supply and discussed the unpaid work in China, empirical studies on the impact of parent care giving on middle-aged women's employment are scarce. Using the longitudinal data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015, Chap. 3 investigates the influence of parent care giving on probability of work participation of women aged 45–69 in China. The random-effects model and the instrumental variables (IV) method are used to address the unobserved heterogeneity and endogeneity problems. The main findings are as follows. First, the number of parents living, number of siblings, and individual characteristics such as education, age, health status, family structure (number of children, household income), and labor market segmentation factors (urban or rural areas) may influence the probability of middle-aged and older women providing the caring for parents. Second, although the results in previous studies that used younger and middle-aged women (i.e., women aged 18–52) indicate that parent care negatively affects women's labor supply, this chapter focuses on middle-aged and older women aged 45–69 and finds that the probability of work participation is higher for the care-giving group. This can be explained by the fact that the positive effect (obtaining income effect) is higher than the negative effect (time-constraint effect). Third, the influences of caring for parents on women's work participation differ by group. Concretely, the influence for women aged 50–59, the well-educated, and low-income women is greater than that for their counterparts. These results indicate that, in China, most women who care for parents are likely to participate in work simultaneously; it can be considered that women who care for parents have to work to obtain money for expenditures associated with parent care. This suggests that the work-family conflict caused by parent care may remain among middle-aged and older women. An elderly care insurance policy should be considered to reduce the burden of caring for parents.

Chapter 4 investigates the influence of labor market segmentation by enterprise ownership sectors on the gender wage gap in the 2000s. Although the Chinese government has introduced a number of new policies and regulations since the 1980s to address the gender gap in labor markets, the gender wage gap has been growing during the transition period. The expansion of the gender wage gap in urban China can be explained in many ways. Although some empirical studies have investigated the determinants of the gender wage gap in urban China during the transition period, empirical studies of the detailed decomposition by different ownership sectors on the gender wage gap are scarce. Using data of the Chinese Household Income Project (CHIP) surveys conducted in 2003 and 2014 (CHIPs 2002 and CHIPs 2013), Chap. 4 explores the determinants of the gender wage gap by five kinds of ownership sectors—the government organization, state-owned enterprises (SOEs), collectively owned enterprises (COEs), privately owned enterprises (POEs), and the self-employment sector—from 2002 to 2013 in urban China. A decomposition analysis of the gender wage gap based on the Blinder-Oaxaca decomposition model is employed. Several major conclusions emerge. First, the gender wage gap exists in

the urban labor market. When all factors—including the human capital factor—and ownership dummy variables are constant, the gender wage gap remains in both 2002 and 2013. Second, both the gender difference in human capital and discrimination against female workers contribute to the gender wage gap; the influence of the unexplained component (e.g., discrimination against female workers) increased in each ownership sector from 2002 to 2013. The range of the increase in the influence of the unexplained component is greater for firms in the public sector than for those in the private sector. Third, the influence of factors on the gender wage gap differs by ownership sector. Concretely, (1) work experience years in the explained component and years of work experience in the unexplained component are the main factors for government organizations; (2) the industry sector in the explained component and ethnic and health status in the unexplained component are the main factors for SOEs; (3) the occupation in the explained component and the industry in the unexplained component are the main factors for COEs; (4) the industry in the explained component and the work experience years in the unexplained component are the main factors for FOEs; (5) the industry sector in the explained component and the occupation as well as education in the unexplained component are the main factors for the self-employment sector. Because the main factors contributing to the gender wage gap differ by ownership sector, policies to address the gender wage gap problem should be different for each ownership sector.

Chapter 5 investigates the determinants of becoming a member of Communist Party of China (CPC) and the impact of CPC membership on the wages, and compare the differences of mechanisms by gender. In China, despite the drastic transition from a planned economy to a market-oriented economy, because the government has employed a gradual reform, the de facto Communist Party of China dictatorship is strongly maintained in the political sphere. This fact creates a unique aspect of the Chinese economy. There is no doubt that the wage premium of CPC membership is an important research topic in the study of the Chinese labor market. Nevertheless, neither theoretical nor empirical studies can reach a certain conclusion on this issue. Thus, empirical studies should be employed. Chapter 5 uses an empirical study for the issue. New findings emerge. First, when the other factors are constant, the probability of becoming a CPC member is 7.3–7.7% points lower for female workers than for male workers. This indicates that a gender gap of participation in the CPC organization remains. Second, the wage premium of CPC membership is higher for female workers (around 34.7% points) than for male workers (4.8–30.8% points), and the influence of selection bias on wage levels is greater for female workers than for males. Third, for both female and male workers, when the sample selection bias is controlled, the contribution rate of the unexplained component increases from −19.0 to 232.5% (female) or 11.4 to 139.2% (male); the range of increase of the unexplained component is greater for female workers than for male workers. This indicates that the factors that influence self-selection or being selected to become a CPC member greatly affect the wage gap, and the influence is greater for female workers than for males. Fourth, the decomposition results show that excepting the selection bias, the endowment differentials such as the difference in years of schooling, distributions of occupations, and industry sectors are the main factors affecting the wage gap for

both female and male workers, and the contributions of endowment differentials are greater for female workers than for males.

Chapter 6 explores the gender gap of social participation activity in China. Research findings of the issue for the developed countries suggest that, in many developed countries, volunteer activity is an important part of social life that improves individuals' well-being and increases social capital and community development. Yet empirical studies of participation in volunteer activity for China using national longitudinal survey data are limited. Using the longitudinal data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015, Chap. 6 investigates the determinants of participation in volunteer activity of individuals aged 45–69 in China; it also compares differences in the determinants by gender. The random effects model and instrumental variables (IV) method are used to address unobserved heterogeneity and endogeneity problems. The main findings are as follows. First, when other factors are held constant, the gender gap in the probability of participating in volunteer activity is smaller. Second, to compare differences in the determinants for participating in volunteer activity by gender, the results indicate that six factors (market work, education, income, family care, age, health status) are broadly supported for women and men, but the influence of determinant factors is different by gender. For example, the negative influence of work on participation in volunteer activity is greater for women than for men. The results indicate that participation in the labor market negatively affects participation in volunteer activity. There is a trade-off relationship between working hours and leisure time (volunteer activities), particularly for women. This may be because that the family responsibilities (e.g., child care, parent care) are greater for women than for men. Therefore, the adjustment of working hours and leisure hours is difficult for women; in other words, it is shown that work-family conflicts may be greater for women than for men. The results indicate that the enforcement of work-life balance policies—including a policy to promote men's participation in housework and the mandatory family care leave system—may increase women's participation in social activity.

Chapter 7 analyzes the impact of Higher Education Expansion Policy (HEEP) on wage of female and male college graduates and compares the effects of the policy by gender. In 1999, the HEEP was implemented by the government. Along with implementation of the policy, the number of college graduates increased from 1.08 million in 1998 to 6.381 million in 2013. According to the general market equilibrium mechanism, when the labor demand is constant, the increased college graduate labor supply in the short term may decrease the graduate wage level (negative effect), whereas, when the labor demand for college graduates increases greatly with economic growth or technological progress, the college graduate wage level may increase even after the implementation of the HEEP (positive effect). Thus, the influence of the policy is not clear, and it deserves empirical investigation. Based on the quasi-natural experiment methods (DID method and DDD method), using six waves (1997, 2000, 2004, 2006, 2009, and 2011) longitudinal survey data of the China Health and Nutrition Survey (CHNS), Chap. 7 investigates the influence of the HEEP on the wage levels of young college graduates. We also compare the different policy influences by gender. Five major conclusions emerge. First, in general, the HEEP does not affect the wage

levels of young college graduates. Second, the difference of policy impact on wages by various wage percentiles is small. Third, the HEEP decreased the wage level of new college graduates in the short term (in 2004), whereas the negative effect disappears in the long term (in 2006, 2009, and 2011). Fourth, to consider the group heterogeneities of policy impacts, the results suggest that gender differences in the impacts of the policy on the wage levels of new college graduates are small.

1.3 Significance of the Book

The main features can be summarized as follows. First, this book provides the academic evidences about these issues based on the economics theories and econometric analysis methods using many kinds of long-term Chinese national survey data including cross-section survey data—Chinese Household Income Project survey (CHIPs), Chinese national longitudinal surveys data—Chinese Health and Nutrition Survey (CHNS), and China Health and Retirement Longitudinal Survey (CHARLS). The latest survey data are used which can provide new evidences for these issues.

Second, this book investigates the consequences and causes of gender gap in both household and labor market perspectives, particularly the new issues such as the association of parent care and female employment, the gender gap of Communist Party of China, and the gender gap of volunteer activity are estimated which are not analyzed in the previous studies.

Third, this book also aims to provide academic evidence for policy-maker, therefore the book conducts the empirical study about the influences of policies such as the New Rural Pension Scheme (NRPS) and Higher Education Expansion Policy (HEEP) on female employment and wage. This book can generate interests for various groups such as scholars with econometric analysis backgrounds, policy makers, and readers who are interested in Chinese economy.

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Part I
Women's Family Responsibilities and Employment in China

Chapter 2
Market Wage, Child Care and the Employment of Married Women

Abstract This study analyzes the market wage, reservation wage, and unearned income on the probability of work participation of married women by using the longitudinal data of China Health and Nutrition Survey from 1989 to 2015 and a random effects probit model to address the heterogeneity problem. It is found the market wage positively affects the probability of work participation of married women; the reservation wage negatively affects the probability of work participation of married women; but the effect of unearned income is not statistically significant, which contrasts with most studies of developed countries. These effects differ by age and *hukou* (urban and rural) groups.

Keywords Wage · Child care · Employment · Married women · China

2.1 Introduction

Female labor force participation changes with economic development, which may influence not only individual or household consumption behavior but also the population structure and future economic growth (Goldin 1990). In developed countries, the empirical study of female employment, especially the employment of married women, is one of the most important research issues (Smith 1980; Killingsworth and Heckman 1986; Goldin 1990; Blundell and MaCurdy 1999). It has been pointed out that economic factors such as the market wage, the reservation wage (e.g., child care), and unearned income greatly influence the employment of married women (Hofferth 1984; Waite et al. 1985; O'Connell and Bloom 1987; Wenk and Garrett 1992; Del Boca et al. 2004; Buckles 2008; Miller 2011), but few empirical studies focus on China.[3] This study mitigates this neglect.

Regarding female labor force participation in China, in the period of the planned economy (1949–1977), the Chinese government enforced a set of policies to promote gender equality at work and in society; as a result, the employment of women was promoted, and the gender gap in the labor market was not noticeable (Gustaffson and Li 2000; Pan 2002; Ma 2011). However, since the 1978, as China reformed its economic system from a planned economy to a market-oriented economy, the employment status of women has changed greatly. For example, in state-owned

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enterprises (SOEs), the proportion of laid-off workers was higher for females than for males when SOE reform was promoted by the Chinese government,[1] and the gender wage gap increased during the market-oriented economy reform period (Ma 2009a, 2018a, b; Iwasaki and Ma 2020). In addition, it was found that the female labor force participation rate decreased in the current period. China's population is aging. In additions, in China, population aging is rapidly progressing in recent years. Based on the data of National Bureau of Statistics (2019), the percentage of population aged 65 and over to total population (the aging population ratio) increased from 4.2% in 1982 to 7.0% in 2000, and 10.5% in 2015; It is predicted that the Chinese aging population ratio will reach 14% in 2026, which means that the population aging will progress quickly for China than the developed countries such as Japan in the future. Therefore, increasing the female labor force participation rate (FLFPR) has become an important issue for the Chinese government. Moreover, the family and population policies, which are related to female employment, have changed in the 2000s. As it is well known, the Chinese government enforced a one-child policy[2] since 1979, and the total fertility rate (TFR) decreased greatly after the policy's implementation. To address the imbalance of the demographic structure, the Chinese government abolished the one-child policy and implemented a set of population policies such as the selective two-child policy in the 2000s and the universal two-child policy in 2016.[3] It can be assumed that these population policy changes may influence women, particularly married women's employment. Thus, empirical study of the determinants of the employment of married women in China has become an important issue. However, although some research has focused on the issue, studies on the impact of the market wage, the reservation wage (e.g., child care), and unearned income (e.g., husband's income)—which has been investigated for developed countries—are scarce for China. This study can remedy this neglect.

Using long-term longitudinal survey data (CHNS: China Health and Nutrition Survey from 1989 to 2015), this study investigates economic factors—including the market wage, the reservation wage, and unearned income—on the probability of participation in work of Chinese married women. A random effects (RE) probit regression model is used to address the heterogeneity problem, which was not considered in most previous studies.

The remainder of the chapter is structured as follows: Sect. 2.2 reviews the related theories and summarizes the results of previous empirical studies on the effects of the market wage, the reservation wage, and unearned income on the employment of married women. Section 2.3 presents the empirical method, including the models, data, and variable setting. Section 2.4 reports the descriptive statistical results. Section 2.5 presents and discusses results of the econometric analysis. The final section summarizes the conclusions and policy implications.

2.2 Literature Review

2.2.1 Economic Theories on the Labor Supply

From the labor supply perspective, according to the general equilibrium model (individual utility maximum model), an individual's choice to participate in work is determined by economic factors—the market wage, the reservation wage (e.g., child care), and unearned income (e.g., husband's income) as follows.

First, when the market wage exceeds the reservation wage, an individual is likely to work.

Second, when unearned income rises, the labor supply may decrease if leisure time is a superior good.

Third, when the market wage rises, the labor supply may increase due to the substitution effect, while the labor supply may decrease due to the income effect if leisure is a superior good. Because the influence of changes in the market wage on the labor supply depends on two effects—the substitution effect and the income effect—the net effect of the market wage on the labor supply is not clear.

In addition, it should be considered that some noneconomic factors such as gender role consciousness and unobserved individual heterogeneity may also affect the choice to work.

To sum up, from the economics theory of labor supply perspective and individual heterogeneity, which determine each individual's preference for work or leisure, the influences of the market wage, the reservation wage, and unearned income are not clear. An empirical study should be conducted to estimate the effects of these factors.

2.2.2 Empirical Studies on the Impact of the Market Wage, Child Care, and Unearned Income on the Employment of Married Women

In this section, we mainly summarize the results of the effects of the market wage, the reservation wage (e.g., child care), and unearned income (e.g., husband's income) on the labor supply of married women.[4]

First, for the effects of the market wage, the results of empirical studies are mixed. For example, Layard et al. (1980), Franz and Kawasaki (1981), and Zabalza (1983) found that the market wage positively influences the employment of married women, while Nakamura and Nakamura (1981) reported that the market wage negatively affects the employment of married women aged 35–39. Dooley (1982) confirmed the negative effect for black married women aged 35–39 and 40–44, and Blundell and Walker (1982) reported that when controlling for the husband's work hours, the market wage negatively affects the employment of wives with two children. For China, Ma (2009a) found that the market wage positively affected the employment

of married women in 2002, while the effect of the market wage was not significant in 1995.

Second, regarding the impact of the reservation wage (particularly child care) on the employment of married women, for developed countries, Hofferth (1984), Waite et al. (1985), O'Connell and Bloom (1987), Wenk and Garrett (1992), Del Boca et al. (2004), Buckles (2008), and Miller (2011) reported that the number of children negatively affects the employment of mothers. The results for China are mixed. For example, Jia et al. (2013) and Yu and Xie (2014) found that the women' employment changed after childbearing. Zhang (2011) and Yang and Bai (2017) reported that the number of children negatively affects the women' participation in work. However, Ma (2009a) found that the influence of the youngest child's age is not statistically significant.

In addition, the labor supply also affects the choice of employment status (choosing to become a regular worker or an irregular worker). For the association of child care and irregular work, in studies of developed countries, Bardasi and Gornick (2000) used international data from five developed countries (Canada, Germany, Italy, the UK, and the USA) and found that the mothers are more likely than childless women to become part-time workers. Drobnic et al. (1996) found that, in Germany, the probability of becoming part-time workers is higher for mothers. Shikata and Ma (2006) and Ma (2008, 2009b) found that, in Japan, women with a younger child or with more children are more likely to become irregular workers. However, empirical studies about child care and irregular work are scarce for China.[5]

Third, for the effects of unearned income, the results of empirical studies are mixed. Heckman (1976, 1980), Cogan (1980a, b), Schulz (1980), Hanoch (1980), Zabalza (1983), and Franz and Kawasaki (1981) found that when the husband's income rises, the labor supply of married women increases; the elasticities of the husband's income to the wife's labor supply are positive values from 0.03 to 15.35. However, Nakamura, Nakamura, and Cullen (1980) and Nakamura and Nakamura (1981) reported that the wife's labor supply decreases as her husband's income rises; the elasticities of the husband's income to the wife's labor supply are negative values from -0.12 to -1.06. For China, Ma (2009a) used Chinese Household Income Project survey (CHIPs 1995 and CHIPs 2002) data and found that although unearned income (household income excluding the respondent's income) negatively affected the employment of urban married women in both 1995 and 2002, the effect of unearned income is not significant.

As compared with previous studies, the main contributions of this study can be summarized as follows. First, although empirical studies for both developed countries and China found that the market wage, child care, and unearned income influence the employment of married women, the results are mixed. This can be explained by the survey data and methodology. Concretely, in most of these previous studies, cross-sectional survey data were used. Because of gender role consciousness or unobservable personality differences in individuals, the heterogeneity problem may remain in these results. This study uses longitudinal survey data and a random effects model to address the heterogeneity problem. Second, China has experienced an economic transition from a planned economy to a market-oriented economy; therefore, the

mechanism of the labor supply of married women may differ from those in developed countries. However, empirical studies about the influences of the market wage, child care, and the husband's income for China are scarce. Although Ma (2009a, b) analyzed the issue, the analyzed periods are 1995 and 2002, and new analysis using the latest survey data is needed. By using CHNS from 1989 to 2015, this study can provide new evidence for the issue.

2.3 Methodology and Data

2.3.1 Model

First, the market wage of married women is an imputed wage based on the wage function. To address the sample selection bias, the Heckman two-step model (Heckman 1979) is used, which is expressed by Eqs. (1.1) and (1.2):

$$\Pr\left(Y_i^* > 0\right) = \Pr(\alpha + \beta_H H_i + \mu_i > 0) \tag{1.1}$$

$$lnWage_i = b + \gamma_1 X_i' + \gamma_2 \lambda_i + \in_i \tag{1.2}$$

In Eqs. (1.1) and (1.2), i indicates the individual, $\Pr\left(Y_i^* > 0\right)$ is the probability of participation in work, and $lnWage$ is a logarithmic value of the hourly wage. H, X expresses the variables, β, γ is the coefficient of each variable, a, b is a constant item, and μ, $\in$ is an error item. The adjusted item (λ) is calculated based on the density function and the distribution function of the probit regression model ($\lambda = \phi(.)/\Phi(.)$).

Second, the probability of participating in work can be estimated by using the probit regression model:

$$\Pr\left(Y_i^* > 0\right) = \Pr\left(c + \beta_1 \bar{W}_i + \beta_2 RW_i + \beta_3 Hin_i + \beta_4 X_i + \varepsilon_i > 0\right). \tag{2.1}$$

In Eq. (2.1), i indicates the individual, c is constant, $\bar{W}$ is the imputed market wage of married women, RW is the reservation wage (here, the number of children and the age of the youngest child), Hin is unearned income (here, the husband's income), X is another variable, β *are* the coefficients of variables, and ε is the error term.

If ε includes an individual-specific, time-invariant factor (u_i), heterogeneity problems may occur when it is not considered. To address this problem, a random effects (RE) probit regression model is used. The RE probit regression model is expressed by Eq. (2.2):

$$\Pr\left(Y_{it}^* > 0\right) = \Pr\left(c + \beta_1 \bar{W}_{it} + \beta_2 RW_{it} + \beta_3 Hin_{it} + \beta_4 X_{it} + u_i + v_{it} > 0\right). \tag{2.2}$$

In Eq. (2.2), i indicates the individual; t represents the year; u_i is an individual-specific, time-invariant factor; and v_{it} is the real error term.

To estimate the probability of employment status, including three types—(A) non-work, (B) irregular work, and (C) regular work—a multinomial probit regression model is used, which is expressed by Eqs. (2.3.1)–(2.3.3):

$$\Pr_A\left(Y_{Ai}^* > 0\right) = \Pr\left(a + \beta_A' X_{Ai}' + e_{Ai} > 0, c + \beta_c' X_{ci}' + e_{ci} < a + \beta_A' X_{Ai}' + e_{Ai}\right), \tag{2.3.1}$$

$$\Pr_B\left(Y_{Bi}^* > 0\right) = \Pr\left(b + \beta_B' X_{Bi}' + e_{Bi} > 0, c + \beta_c' X_{ci}' + e_{ci} < 0, a + \beta_A' X_{Ai}' + e_{Ai} < 0\right), \tag{2.3.2}$$

$$\Pr_C\left(Y_{ci}^* > 0\right) = \Pr\left(c + \beta_c' X_{ci}' + e_{ci} > 0, c + \beta_c' X_{ci}' + e_{ci} > a + \beta_A' X_{Ai}' + e_{Ai}\right). \tag{2.3.3}$$

2.3.2 Data and Variable Setting

Data from the China Health and Nutrition Survey (CHNS) from 1989 to 2015 are used in this study. CHNS is a nationwide longitudinal survey data conducted by the Carolina Population Center of the University of North Carolina and the National Institute for Nutrition and Health (NINH, formerly the National Institute of Nutrition and Food Safety) at the Chinese Center for Disease Control and Prevention (CCDC). The survey took place over a 7-day period using a multistage, random cluster process to draw samples from 15 provinces and municipal cities (Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou, Beijing, Shanghai, Chongqing, Shaanxi, Yunnan, Zhejiang) that vary substantially in geography, economic development, and government resources. Three provinces were added in CHNS 2011, and another three provinces joined in 2015. In 1989 of initial survey year, the CHNS surveyed 3,795 households and 15,907 individuals. This study uses data from 10 waves, including the most recently updated data from 2015. The CHNS provides extensive information about fertility and pregnancy history as well as basic social demographic and employment information that facilitate the empirical analysis in this study.

This study investigates the determinants of the employment of married women. The marriage of very young females is regulated by law, and the mandatory retirement age of female workers in the public sector (e.g., government organizations, SOEs) ranges from 45 to 55. Therefore, this study is limited to samples of married women aged 20–44 years, which includes the period of child bearing and child care.

The main dependent variable is a binary probability variable equal to 1 when a woman is working and equal to 0 when she is not working.

The main independent variables are the market wage, the reservation wage, and unearned income. (1) The market wage is an imputed value calculated based on the wage function by using the Heckman two-step model. The dependent variable of the wage function is the logarithmic value of the hourly wage, which is adjusted by the 1989 CPI (consumer price index). The variables in the first step estimation (the function of probability of work participation) include the wife's years of schooling, age and age squared, minority ethnicity, husband's income and squared, number of children, the age of the youngest child, urban/rural *hukou*, region, and survey year dummy variables; the variables in the second-step estimation (the wage function) include the wife's years of schooling, years of work experience and squared, minority ethnicity, urban/rural *hukou*, region, and survey year dummy variables. The results of the wage function are shown in Appendix Table 2.6. The coefficient of the adjusted item (λ) is a negative value and statistically significant at a 1% level, indicating that a sample selection bias problem remains in the results based on the OLS. The coefficients of the wage function are used to calculate the imputed market wage. (2) Three dummy variables of the number of children—one, two, three, and more—and five kinds of dummy variables of the age of the youngest child—0–1, 2–3, 4–5, 6–14, or 15 years and older—are used as indices of the reservation wage. It is assumed that the labor supply of married women may decrease for the group with younger children and with more children. (3) The logarithmic value of the husband's income is used as the index of the unearned income of married women, which is adjusted by the 1989 CPI.

The other covariates are used to control other influences on the women' employment. (1) The culture and willingness to work may differ for the various ethnic groups; therefore, the minority ethnicity dummy (Han ethnicity = 0; minority ethnicity = 1) is used. (2) In China, there is considerable disparity of culture, lifestyle and social policies between rural and urban areas as related to family size, gender role consciousness, as well as formal and informal child care support and the public provision of child care (Zhang 2011). Therefore, the urban dummy variable (urban areas = 1; rural areas = 0) is constructed to control these disparities. (3) The level of economic development and the macroeconomic environment differ by region and survey year. Four region dummy variables (Eastern Region, Central Region, Western Region, and Northeast Region) and three period dummy variables (periods from 1989 to 1997, 2000 to 2006, and 2009 to 2015) are used.

Table 2.1 presents the descriptive statistics of variables by working and non-working married women. We employed the *t*-test to investigate the differences between these two groups. In general, the total employment rate (percentage of working individuals to the total samples in each group) is 83.1%; the proportions of nonworkers, irregular workers, and regular workers are, respectively, 16.9%, 49.6% and 33.4% for married women aged 20–44. It is observed that the individual characteristics of these two groups differ significantly. For example, working married women have fewer years of schooling and are less likely to have children aged 0–3 than non-working group. Economic factors of these two groups also differ. For example, the imputed market wage and husband's income are lower for working

Table 2.1 Descriptive statistics of variables

	Total (a)	Work (b)	Non-work (c)	D (b)–(c)	t-test
LP	0.831	1	0		
Employment status					
Non-work	0.169	0	1		
Irregular	0.496	0.597	0		
Regular	0.334	0.403	0		
Imputed wage	8.713	8.678	9.153	−0.475***	$p < 0.001$
Wife' years of schooling	7.715	7.575	8.384	−0.809***	$p < 0.001$
Husband' years of schooling	9.051	9.018	9.193	−0.175***	0.008
Number of children					
One	0.496	0.464	0.521	−0.057***	$p < 0.001$
Two	0.352	0.356	0.384	−0.028***	$p < 0.001$
Three and more	0.153	0.180	0.095	0.085***	$p < 0.001$
Age of youngest child					
Age 0–1	0.115	0.112	0.166	−0.054***	$p < 0.001$
Age 2–3	0.121	0.122	0.125	−0.003***	0.603
Age 4–5	0.118	0.122	0.092	0.030***	$p < 0.001$
Age 6–14	0.454	0.465	0.385	0.080***	$p < 0.001$
Age 15 and over	0.192	0.178	0.233	−0.055***	$p < 0.001$
Unearned income	9.797	9.805	9.835	−0.030***	$p < 0.001$
Minority ethnicity	0.130	0.122	0.120	0.002***	0.676
Urban	0.287	0.297	0.152	0.145***	$p < 0.001$
Region					
East	0.232	0.251	0.187	0.064***	$p < 0.001$
Central	0.355	0.339	0.398	−0.059***	$p < 0.001$
West	0.254	0.251	0.207	0.044***	$p < 0.001$
Northeast	0.159	0.160	0.208	−0.048***	$p < 0.001$
Period					
y 1989–1997	0.413	0.518	0.161	0.357***	$p < 0.001$
y 2000–2006	0.297	0.265	0.391	−0.126***	$p < 0.001$
y 2009–2015	0.290	0.218	0.448	−0.230***	$p < 0.001$
Observations	11,522	9,575	1,947		

Sources Calculated based on CHNS 1989–2015
Note Age is limited from 20 to 44

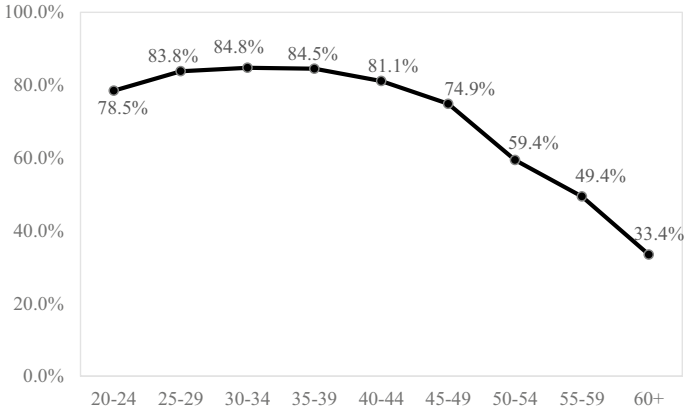

Fig. 2.1 Female employment rate by age. *Source* Calculated based on CHNS 1989–2015

married women than for non-working group. Therefore, analyses should control for these factors.

Figure 2.1 shows the female employment rate (percentage of working women to total samples in each age group) by age group. First, the female employment rate is maintained at a higher level (around 80%) for Chinese married women aged 25–39. In Japan and Korea, the female employment rate by age group is an M-shaped curve that is lowest in the period of marriage and child care (Ma 2011). This indicates that the negative effect of child care on maternal employment may be smaller in China than in Japan and Korea.

Second, although the employment rate for married women aged 25–44 is maintained at around 80%, it decreases greatly for married women aged 50 and older. Concretely, the employment rates are 59.4%, 49.4% and 33.4% for married women aged 50–54, 55–59, and older than 60 years, respectively. The results can be explained by China's mandatory retirement system. In the public sector (e.g., government organizations, SOEs), the mandatory retirement age is 50 years for female workers (blue-collar workers) and 55 years for female cadres (white-collar workers), which causes a sharp decline of female employment rate for the group aged 50 and over.

2.3.3 Female Employment Rate by Age and Education

The female employment rate by age and education groups are shown in Fig. 2.2. It is observed that, in general, the employment rate is higher for the low-education group than for both the middle-level group and the high-level education group. In addition, for married women aged 55 and older, the female employment rate is lower for the highly educated group than for both the low- and middle-level education groups.

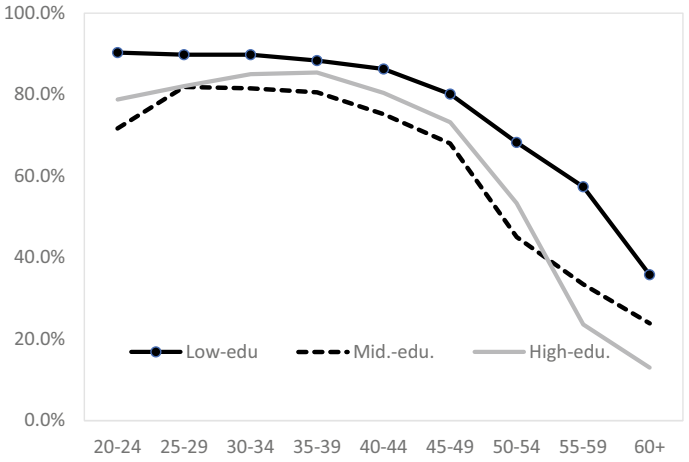

Fig. 2.2 Female employment rate by age and education. *Source* Calculated based on CHNS 1989–2015. *Note* High_edu.: college and over; Mid-edu.: senior high school or junior high school; Low_edu.: primary school and lower

The explanation is as follows. Based on the marriage-matching model, the probability of marrying a well-educated man is higher for a well-educated woman than for a woman with low-education level. According to the human capital theory (Becker 1964; Mincer 1974), the total household income may be lower for low-education women than for highly educated women; therefore, low-education married women must work more in the labor market to support their families. In addition, most highly educated married women age 55 and older retire from the public sector and receive higher pension benefits, which may cause the female employment rate decreased.

2.3.4 Female Employment Rate by Age and Unearned Income

The female employment rate by age and unearned income group is shown in Fig. 2.3. The unearned income groups include the low-income group (first tertile), the middle-income group (second tertile), and the high-income group (third tertile) based on their husband's income. It can be observed that, in each age group, the female employment rate is lowest for the high-income group, while it is highest for the low-income group.

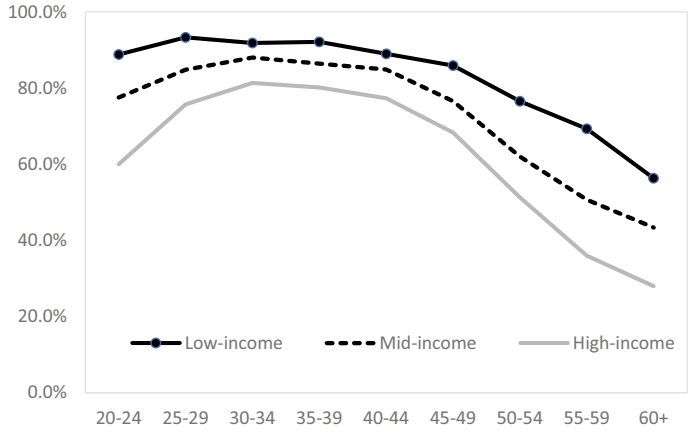

Fig. 2.3 Female employment rate by age a and unearned income. *Source* Calculated based on CHNS 1989–2015. *Note* Non-earning income = husband income; Low-income: first tertile; Mid-income: second tertile; High-income: third tertile

2.3.5 Female Employment Rate by Age and Number of Children

The female employment rate by age and number of children is shown in Fig. 2.4. We calculated for three groups—women with one child, two children, and three or more children. First, the female employment rate is highest for the group with three or more children. Second, the differential of employment rate is small between women with one child and those with two children. This indicates that mothers with

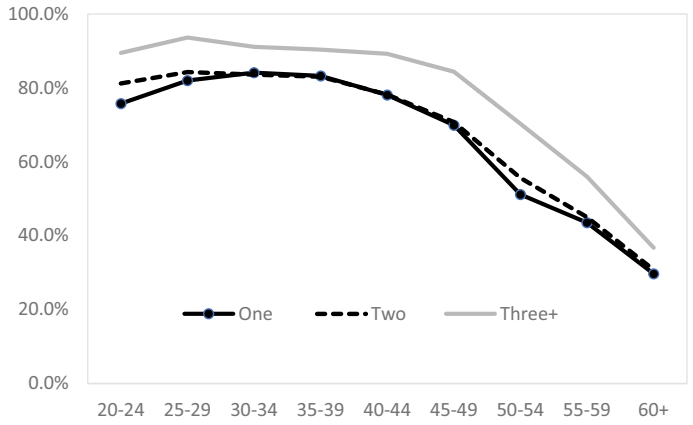

Fig. 2.4 Female employment rate by age and number of children. *Source* Calculated based on CHNS 1989–2015

more children (three or more) are likely to work. The differentials of employment rate between mothers with one child and those with two indicates that the negative influence of child care on maternal employment is small. Regarding the influences of China's population policies, the analyzed period in this study is from 1989 to 2015, while the one-child policy was implemented in 1979, and the two-child policy was implemented in 2016. Thus, the effects of the current period's two-child policy on maternal employment should be evaluated in the future by using new survey data after 2016.

To summarize, it is observed that the female employment rate differs by age, education level, unearned income level, and number of children. It should be noticed that these are results when other factors are not controlled. The effects of the market wage, the reservation wage, and unearned income estimated by econometric analyses after controlling for other factors that might affect women's choice to work are reported as follows.

2.4 Econometric Analysis Results

2.4.1 The Market Wage, Child Care, Unearned Income, and Work Participation of Married Women in China

Table 2.2 presents the estimation results of the probability of participation in work by using the probit regression model and random effects (RE) probit regression models. The likelihood ratio (LR) test indicates that the RE probit model is appropriate. The new findings based on RE probit model results can be summarized as follows.

First, it is shown that the market wage positively affects the probability of work participation of married women; the probability of participation in work increases as the market wage rises. These results are consistent with those of Layard et al. (1980), Franz and Kawasaki (1981), and Zabalza (1983) for developed countries. This indicates that when the market wage rises, the substitution effect is greater than the income effect, which increases the employment probability of married women in China.

Second, the reservation wage negatively affects the work participation of married women. Concretely, as compared with a mother with one child, the probability of participation in work is lower for a mother with two or more children. As compared with a mother with a child aged 0–1, the probability of participation in work is higher for a mother with a child aged 4–5 or 6–14. These results are consistent with those of Hofferth (1984), Waite et al. (1985), O'Connell and Bloom (1987), Wenk and Garrett (1992), Del Boca et al. (2004), Buckles (2008), and Miller (2011) for developed countries and Zhang (2011) and Yang and Bai (2017) for China.

As compared with the results of Ma (2009a, b), who reported the influence of the age of youngest child on the employment of married women is not significant, the negative effect of child care on maternal employment is suggested to have increased

Table 2.2 Probability of participation in work of married women in China

	Probit		Probit_RE	
	Coef.	S.E.	Coef.	S.E.
Imputed wage	0.384***	0.152	0.506**	0.202
Number of children (One)				
Two	−0.182***	0.046	−0.228***	0.064
Three and more	−0.152**	0.064	−0.195**	0.088
Age of youngest child (Age 0–1)				
Age 2–3	0.136	0.089	0.162	0.109
Age 4–5	0.223**	0.089	0.244**	0.108
Age 6–14	0.148**	0.072	0.152*	0.089
Age 15 and over	−0.066	0.079	−0.122	0.101
Unearned income	−0.011	0.018	−0.013	0.023
Minority ethnicity	−0.043	0.061	−0.060	0.085
Urban	0.309***	0.051	0.393***	0.071
Region (East)				
Central	−0.255***	0.058	−0.328***	0.081
West	0.120*	0.073	0.130	0.099
Northeast	−0.399***	0.062	−0.491***	0.088
Period (y 1989–1997)				
y 2000–2006	−1.051***	0.191	−1.350***	0.257
y 2009–2015	−1.455***	0.310	−1.849***	0.416
Constants	−1.004	1.216	−1.448	1.620
Observations	11,522		11,522	
Groups			4,920	
Log likelihood	−2585.964 0.082		−2535.901	
LR test of rho = 0:			chibar2 (01) = 100.13 Prob > = chibar2 = 0.000	

Source Calculated based on CHNS 1989–2015
Notes ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

in the current period over that in the past. This indicates that the family-work conflict problem has grown worse with the progress of the market-oriented economy reform. The results can also be explained by the fact that, as the economic development and the household income increased, some married women choose to become housewives and exit the labor market voluntarily.

Third, the effect of unearned income is not statistically significant. Although the results in Fig. 2.4 show that the female employment rate is lowest for the high-income group and higher for the low-income group, it seems likely that a husband's income may negatively affect their wife's work participation. However, when the other factors

are controlled, the effect of husbands' incomes on their wives' employment is not significant in China. The finding contrasts with those of most studies of developed countries. This may be caused by the fact that gender equality in workplace and family has been promoted by the government since the planned economy period; thus, most married women are willing to work and they are independent of their husbands' incomes.

Fourth, other factors also affect the probability of participation in work of married women. (1) The probability of participation in work is higher for urban women than for rural women. (2) As compared with women in the central and northeast regions, women in the eastern region are more likely to work. This may result from the fact that, when women in urban areas or regions in which the level of economic development is higher (eastern regions), better chances for jobs may increase the probability of working. (3) As compared with the past period (the period of 1989–1997), the probability of participation in work decreased in the current period (the periods of 2000–2006 and 2009–2015). This is confirmed by the fact that female labor force participation rate decreased during the market-oriented economy reform period.

2.4.2 Results by Group

To examine the heterogeneity problem between various groups, a set of subsamples was used. We mainly summarized the findings about the market wage, child care, and husband's income in the following.

(1) ***Results by Age***

The results for three age groups—aged 20–29, 30–39, and 40–49—are shown in Table 2.3. First, the market wage positively affects the employment of women aged 20–29 and 30–39 (2.162, 0.693, respectively), while the effect is negative for those aged 40–49. These results are significant at 1 and 5% levels. This suggests that the effect of the market wage on the employment of married women differs by age group; the market wage has a negative effect for middle-aged married women, while it has a positive effect for younger married women. These results are similar to those of Dooley (1982), who found that the market wage positively affects the employment of black married women aged 30–34, while its effect is negative for black married women aged 35–39 and 40–44.

Second, regarding the effect of the reservation wage, (1) for younger mothers (the group aged 20–29), the influence of both the number of children and the age of the youngest child on the employment of married women are not significant. In contrast, for married women aged 30–39 and 40–49, as compared with a mother with one child, the probability of participation in work is lower for a mother with two children. (2) For married women aged 30–39, as compared with a mother with a child aged 0–1, a mother with a child aged 4–5 or 6–14 years is more likely to

Table 2.3 Results by age

	(1) Age 20–29		(2) Age 30–39		(3) Age 40–49	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Imputed wage	2.162***	0.783	0.693**	0.304	−0.795***	0.239
Number of children (One)						
Two	0.135	0.210	−0.312***	0.093	−0.246***	0.072
More than three	0.029	0.355	−0.234*	0.136	−0.133	0.089
Age of youngest child (Age 0–1)						
Age 2–3	0.068	0.201	0.308*	0.170	0.771	0.564
Age 4–5	0.111	0.222	0.577***	0.166	0.589	0.485
Age 6–14	0.291	0.282	0.417***	0.139	0.710*	0.431
Age 15 and over			0.163	0.174	0.444	0.430
Unearned income	−0.096	0.084	−0.042	0.034	0.005	0.025
Minority ethnicity	−0.086	0.283	0.002	0.119	0.013	0.096
Urban	0.695**	0.284	0.425***	0.102	−0.002	0.073
Region (East)						
Central	−0.532*	0.308	−0.267**	0.112	−0.333***	0.082
West	−0.028	0.347	0.257*	0.140	0.122	0.103
Northeast	−1.140***	0.359	−0.461***	0.121	−0.275***	0.092
Period (y 1989–1997)						
y 2000–2006	−3.790***	1.089	−1.612***	0.383	0.346	0.298
y 2009–2015	−6.059***	1.745	−2.187***	0.623	0.900*	0.482
Constants	−12.687**	5.863	−2.938	2.456	8.239***	2.027
Observations	2,123		5,819		6,797	
Groups	1,534		3,331		3,645	
Log likelihood	−366.48		−1162.84		−2274.46	
LR test of rho = 0:	chibar 2 (01) = 17.33		chibar 2 (01) = 25.65		chibar 2 (01) = 71.81	
Prob ≥ chibar2	0.000		0.000		0.000	

Source Calculated based on CHNS 1989–2015
Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Random effects probit regression model is used

work; while the influences of the age of the youngest child on the labor supply are not significant for mothers aged 20–29 and those aged 40–49. The negative effect of child care seems to be greater for mothers aged 30–39 who are in an important period of career development. This suggests that the family–work conflict problem may worse for married women aged 30–39 years.

Third, the effect of the husband's income is not significant in each age group, which confirms the conclusions shown in Table 2.2 by using total samples.

(2) ***Results by Urban and Rural Areas***

Table 2.4 summarizes the results by urban areas and rural areas. First, the effect of the market wage on the labor supply differs by area (urban or rural). The market wage positively affects the labor supply of married women in urban areas, while the influence is not significant for married women in rural areas. This may be caused by the fact that the function of the market mechanism is weaker in rural areas than in urban areas; therefore, the influence of the market wage on the labor supply is smaller for married women in rural areas. It also can be explained by differences in gender role consciousness among urban and rural areas. The influence of Confucianism

Table 2.4 Results by urban areas and rural areas

	(1) Urban		(2) Rural	
	Coef.	S.E.	Coef.	S.E.
Imputed wage	2.223***	0.611	0.004	0.216
Number of children (One)				
Two	−0.431**	0.177	−0.164**	0.066
More than three	−0.348	0.310	−0.202**	0.090
Age of youngest child (Age 0–1)				
Age 2–3	0.785**	0.359	0.100	0.115
Age 4–5	0.479	0.303	0.264**	0.117
Age6-14	0.398	0.256	0.184*	0.096
Age 15 and over	−0.353	0.276	0.039	0.108
Unearned income	0.009	0.083	−0.013	0.023
Minority ethnicity	0.003	0.280	−0.083	0.088
Region (East)				
Central	−0.397*	0.214	−0.243***	0.087
West	0.111	0.254	0.201*	0.109
Northeast	0.429	0.296	−0.565***	0.092
Period (y 1989–1997)				
y 2000–2006	−3.351***	0.772	−0.800***	0.273
y 2009–2015	−4.751***	1.233	−0.996**	0.443
Constants	−14.965***	4.760	2.509	1.738
Observations	3,228		8,294	
Groups	1,634		3,286	
Log likelihood	−469.11		−2015.55	
LR test of rho = 0:	chibar 2 (01) = 32.38		chibar 2 (01) = 59.92	
Prob ≥ chibar 2	0.000		0.000	

Source Calculated based on CHNS 1989–2015
Note: (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Random effects probit regression model is used

is greater in rural areas (Cheng 2011; Fen and Xiao 2014), and gender wage gap is larger in rural areas (Iwasaki and Ma 2020); therefore, the impact of economic factors—such as the market wage on the employment of rural women—is smaller.

Second, for the effect of reservation wage, (1) for both urban and rural areas, as compared with a mother with one child, the probability of participation in work is lower for a mother with two or more children. (2) Having a child aged 0–1 negatively affects mothers' labor supply for both urban and rural areas. This suggests that child care negatively affects the employment of married women in both urban and rural areas. When we compare the sizes of the coefficients, the negative effect of child care is greater in urban areas than rural areas.

Third, for both urban and rural areas, the effects of a husband's income are not significant, which confirmed the conclusions shown in Table 2.2 by using total samples.

2.4.3 Considering Irregular Work and Regular Work

Regarding the choice of employment status, we used analyses for choosing regular work and irregular work. The results on employment status are summarized in Table 2.5.

There is no common definition of irregular work in previous studies, and the classification of regular work or irregular work is usually based on the number of hours worked, labor contract, or occupation type (i.e. Zhang and Qin 2015; Zhang et al. 2018). In this study, irregular work is defined by the type of occupation, as in the CHNS questionnaire. Irregular workers include self-employed workers with no employees (including farmers), temporary workers, and paid or unpaid family workers. Regular workers include self-employed workers who employ others, those who work for others or work in units (enterprises or organizations) as permanent employees, or workers with a long-term labor contract.

Two models—(i) a multinomial probit regression model and (ii) a random effects probit regression model—are used. The dependent variables are a category variable (1 = nonwork, 2 = irregular work, 3 = regular work) in the multinomial probit regression model, and a binary variable (1 = irregular or regular worker, 0 = nonworker) in the random effects probit regression model. The results by using these two types of model are similar. Regarding the heterogeneity problem, we summarize the findings based on the results of the random effects model as follows.

First, the effect of the market wage differs by whether a person works regularly or irregularly. Concretely, the market wage positively affects the probability of becoming a regular worker, while when the market wage rises, the probability of becoming an irregular worker is lower than that of becoming a nonworker. This suggests that the substitution effect is greater for regular work, while the income effect is greater for irregular work. This can be explained by the labor market's segmentation into a formal and informal sector. Working hours are longer and the social security is not maintained for workers in the informal sector; therefore, although the

Table 2.5 Probability of regular work and irregular work

	(1) Multinomial probit				(2) RE_probit			
	Irregular/non-work		Regular/non-work		Irregular/non-work		Regular/non-work	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Imputed wage	−1.189***	0.330	4.434***	0.363	-0.810***	0.226	4.419***	0.510
Number of children (One)								
Two	0.102	0.092	−1.137***	0.100	0.060	0.067	−1.126***	0.151
More than three	0.175	0.131	−1.891***	0.154	0.126	0.090	−1.609***	0.233
Age of youngest child (Age 0–1)								
Age 2–3	0.249	0.183	0.485**	0.205	0.141	0.116	0.516**	0.230
Age 4–5	0.475***	0.184	0.646***	0.204	0.270**	0.116	0.731***	0.233
Age 6–14	0.498***	0.147	0.256	0.166	0.270***	0.096	0.200	0.191
Age 15 and over	0.365**	0.162	−0.597***	0.182	0.176*	0.109	−0.681***	0.218
Unearned income	−0.111***	0.038	0.350***	0.045	−0.071***	0.024	0.328***	0.055
Minority ethnicity	−0.078	0.124	−0.268*	0.141	−0.063	0.089	−0.338**	0.202
Urban	−0.773***	0.118	2.172***	0.118	−0.473***	0.087	2.342***	0.207
Region (East)								
Central	−0.460***	0.126	−0.417***	0.133	−0.276***	0.088	−0.664***	0.176
West	0.171	0.157	0.510***	0.167	0.124	0.107	0.588***	0.216
Northeast	−0.784***	0.131	−0.596***	0.139	−0.491***	0.096	−0.792***	0.195
Period (y 1989–1997)								
y 2000–2006	0.279	0.416	−7.103***	0.458	0.283	0.284	−6.692***	0.660
y 2009–2015	0.917	0.672	−10.769***	0.739	0.769*	0.461	−10.24***	1.064

(continued)

Table 2.5 (continued)

	(1) Multinomial probit				(2) RE_probit			
	Irregular/non-work		Regular/non-work		Irregular/non-work		Regular/non-work	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Constants	13.515***	2.656	−36.381***	2.930	9.148***	1.828	−36.259***	4.138
Observations	11,522				7,293		4,896	
Groups					3,213		2,804	
Log likelihood	−6859.139				−2182.7824		−1404.233	
Pseudo R2	0.3127							
LR test of rho = 0: chibar 2 (01)					66.46		211.86	
Prob ≥ chibar 2					0.000		0.000	

Source Calculated based on CHNS 1989–2015
Note ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

market wage may be higher than the reservation wage, the probability of becoming an irregular worker is lower (Ma 2016).

Second, for the effects of child care, (1) the probability of becoming a regular worker decreases for a mother with more than two children, while the impact of the number of children on irregular work is not significant. (2) The age of the youngest child affects the probability of both regular work and irregular work. As compared with a mother with a younger child (e.g., a child aged 0–1), the probability of becoming an irregular worker or a regular worker is higher for a mother with an older child (e.g., a child aged 4–5 or a child aged 15 and over). To compare the size of the age of child dummy variables, the effect of the youngest child's age is greater for regular work. It is observed that the negative effect of child care is greater for regular work. This can be explained as follows. From the labor supply side, the labor supply (e.g., working hours) of irregular workers can be more easily adjusted for (e.g., the self-employed). It is pointed out that irregular work may reduce the work–family conflict. Therefore, the negative effect of child care on the labor supply of married women is smaller for irregular workers than for regular workers.

Third, the results show an interesting finding for the effect of the husband's income. The husband's income positively affects the probability of becoming a regular worker, while it negatively affects the probability of becoming an irregular worker. These results about regular work can be explained by the marriage-matching model. The probability is high that a married, well-educated man who earns a high income will marry a well-educated woman who is likely to become a regular worker. For irregular workers, when the income constraint is held constant, if the unearned income increases, the labor supply may be reduced if leisure is a superior good.

2.5 Conclusions

Using the longitudinal survey data of CHNS from 1989 to 2015, this study analyzes the impact of the market wage, the reservation wage, and unearned income on the probability married women will work. The random effects model is used to address the heterogeneity problem. The main findings and policy implications are as follows.

First, in general, (1) the market wage positively affects the employment of married women; the probability of participation in work increases as the market wage rises. These results are consistent with those of previous empirical studies for developed countries. (2) The reservation wage (here, the number of children and age of the youngest child) negatively affects the employment of married women. (3) The effect of unearned income is not statistically significant, which contrasts with the findings of most studies for developed countries.

Second, the effects differ by age. (1) The market wage has a negative effect for middle-aged married women aged 40–49, while it has a positive effect for younger married women, aged 20–39. (2) The negative effect of child care is greater for mothers aged 30–39. (3) The effect of a husband's income is not significant in any age group.

Third, the effects differ in urban and rural areas. (1) The market wage positively affects the employment of married women in urban areas, while the influence of the market wage on married women is not significant for in rural areas. (2) The negative effect of the reservation wage is greater for married women in urban areas than those in rural areas. (3) For both urban and rural areas, the effects of a husband's income are not significant.

Fourth, for the effects by employment status, (1) the market wage positively affects the probability of becoming a regular worker; when the market wage rises, the probability of becoming an irregular worker is lower than the probability of becoming a nonworker. (2) The negative effect of the reservation wage is greater for regular work. (3) The husband's income positively affects the probability of becoming a regular worker, while it negatively affects the probability of becoming an irregular worker.

The results indicate that child care negatively affects the employment of married women, particularly for women aged 30–39 who are in an important period of career development, and for women in urban areas. As compared with irregular work, the negative effect of child care is greater for regular work. This suggests that as the economy system transitions from a planned economy to a market-oriented economy, the problem of family–work conflict increased, particularly for regular female workers. This may due to the decrease of child care support from firms and government (Maurer-Fazio et al. 2011; Connelly et al. 2018). A child care support policy should be implemented by the Chinese government. The child care support policy can be expected to increase both the total fertility rate and the female labor force participation rate, which contributes to long-term economic growth.

The market wage was found to positively affect the employment of married women, particularly for younger married women aged 20–39, married women in urban areas, and regular workers. This suggests that the influence of the market mechanism on the labor supply of married women has increased with the progress of the market-oriented economy reform. However, it should be noted that the market wage negatively affects the probability of becoming an irregular worker. The result is related to the Chinse labor market segmentation by formal and informal sectors (Zhang and Qin 2015; Ma 2016; Zhang et al. 2018). The number of regular workers has decreased, but the number of irregular workers has increased in the current period. For example, the proportion of female irregular workers to total female workers increased from 33.9% in 1996 to 68.6% in 2010 (Zhang and Hu 2017). As compared with the regular worker group, irregular workers usually earn a lower wage and fewer fringe benefits. Their social security entitlement is poorer, and their probability of becoming unemployed is higher (Ma 2008, 2009a, b, 2011; Wu 2009). Labor and social security policies should be implemented to reduce the gap between the formal and informal sectors.

Finally, it should be noted that this study has limitations. First, although we used RE models to address the heterogeneity problems in the current study, our future research will address the endogeneity problem between child care, husband's income, and labor supply by using other econometric models such as the instrument variable methods. Second, the dynamic model of labor supply should be employed based on

a life-cycle model. Third, for the reservation wage, parent care should be considered; we analyzed the issue in Chap. 3 of this book. Fourth, the effect of these economic factors on working hours has become an issue for our future research. Despite these limitations, we believe that the current study, which takes full advantage of longitudinal survey data, can provide new insight for understanding the association between the market wage, child care, husband's income, and the employment of married women in China under the market-oriented economy reform period. This may add to the evidence of the determinants of the women' employment in China.

Notes

1. Since the 1990s, employment adjustment has been promoted in SOEs. Many significant employees became unemployed. According to the China Labor Statistics Yearbook 2000, about 5 million urban workers were restructured from 1996 to 2000. Ma (2008) and Li (2003) pointed out that the gender gap in the employment adjustment of SOEs was maintained, and the disadvantage of SOE reform is greater for female workers than for male workers. For the analysis of ownership sector and the gender wage gap, please refer to Chap. 4 of this book.
2. The one-child policy was China's family planning policy, which consisted of a set of regulations, including restrictions on the number of children per household and the minimum marriage age. The one-child policy mostly applied to urban residents and public sector employees. In rural regions, if the first child was a girl, a second child was permitted. If both the wife and husband were Chinese citizens returning from abroad, if both the wife and husband are without siblings, and for ethnic minorities, a second child was permitted (Hesketh et al. 2005; Wang et al. 2013). This policy was published in 1979 and abolished in October 2015.
3. In order to address the potential consequences of the one-child policy, such as the aging population and labor shortages, the one-child policy was replaced by the universal two-child policy in October 2015. Based on the new policy, a married woman can have two children. The new law came into force on January 1, 2016.
4. For a detailed survey of the effects of the market wage, the reservation wage, and unearned income on women's labor supply, please refer to Smith (1980), Killingsworth and Heckman (1986), Goldin (1990), and Blundell and MaCurdy (1999).
5. Some previous studies for China explore only the influence of irregular work on childbearing based on the descriptive statistical results (for example, Ding and Shi 2016 and Zhang and Hu 2017).
6. The values of female employment rate in Figs. 2.2, 2.3 and 2.4 are summarized in Appendix Tables 2.7, 2.8 and 2.9.

Appendix

See Tables 2.6, 2.7, 2.8 and 2.9.

Table 2.6 Results of wage function

	(1) One–step		(2) Two-step	
	Probability of work		Wage function	
	Coef.	S.E.	Coef.	S.E.
Wife's years of schooling	0.121***	0.005	0.058***	0.006
Experience year	0.032	0.029	−0.013	0.012
Exp. sq.	−0.000	0.000	0.001**	0.000
Minority ethnicity	−0.077	0.049	0.029	0.047
Husband income	0.223*	0.137		
Husband income_sq.	0.004	0.008		
Number of children	−0.344***	0.023		
Age of youngest child	0.006	0.004		
Urban	1.038***	0.036	−0.193***	0.038
Region (East)				
Central	−0.440***	0.040	−0.151***	0.034
West	−0.390***	0.045	−0.206***	0.039
Northeast	−0.606***	0.045	−0.170***	0.041
Year (1989–1997)				
2000–2006	−0.320***	0.036	1.149***	0.033
2009–2015	0.025	0.045	1.877***	0.033
Constant	−3.278***	0.774	7.726***	0.173
adverse mills ratio			−0.760**	0.051
Observations	11,711			
Selected	5,131			
No-selected	6,580			
Prob > chi 2	0.000			

Source Calculated based on CHNS 1989–2015
Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Heckman two step model is used

Table 2.7 Female employment rate by age and education group

	Low-edu (%)	Mid-edu (%)	High-edu (%)
20–24	90.3	71.7	78.8
25–29	89.8	81.9	82.1
30–34	89.8	81.5	85.0
35–39	88.4	80.5	85.4
40–44	86.3	75.2	80.4
45–49	80.1	68.0	73.2
50–54	68.3	45.0	53.3
55–59	57.4	33.5	23.6
60+	35.8	23.9	13.0

Source Calculated based on CHNS 1989–2015

Table 2.8 Female employment rate by age and husband income group

	Low-income (%)	Mid-income (%)	High-income (%)
20–24	88.8	77.5	60.0
25–29	93.3	84.8	75.7
30–34	91.8	88.0	81.3
35–39	92.1	86.4	80.2
40–44	89.0	84.9	77.3
45–49	85.9	76.6	68.3
50–54	76.6	62.0	51.3
55–59	69.3	50.6	36.0
60+	56.3	43.4	28.0

Source Calculated based on CHNS 1989–2015

Table 2.9 Female employment rate by age and number of children group

	One (%)	Two (%)	Three+ (%)
20–24	75.7	81.3	89.5
25–29	82.0	84.3	93.7
30–34	84.1	83.6	91.2
35–39	83.2	83.1	90.4
40–44	78.1	78.2	89.3
45–49	70.0	70.8	84.4
50–54	51.2	55.7	70.3
55–59	43.5	45.0	56.0
60+	29.7	30.8	36.7

Source Calculated based on CHNS 1989–2015

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Chapter 3
Parent Care and Middle-Aged Women's Employment

Abstract Does parent care influence Chinese women's participation in work? Using the longitudinal data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015, this study investigates the influence of parent care giving on probability of work participation of women aged 45–69 in China. The random-effects model and the instrumental variables (IV) method are used to address the unobserved heterogeneity and other endogeneity problems. Although the results in previous studies that used younger and middle-aged women (i.e., women aged 18–52) indicate that parent care negatively affects women's labor supply, the results indicate that the probability of work participation is higher for the care-giving group. This can be explained by the fact that the positive effect (obtaining income effect) is higher than the negative effect (time-constraint effect). We also found that the influences of caring for parents on women's work participation differ by age and education group.

Keywords Parent care · Work participation · Middle-aged women · China

3.1 Introduction

As is well known, the main givers of family care—including parent care—are women. According to family economics (Becker 1985), the prospect for work in the labor market is higher for men, while the prospect of housework is higher for women; therefore, based on the individual and household utility maximum model, most women assume responsibility for the family, while most men work in the labor market. Therefore, parent care may affect the women's employment. Some previous studies for developed countries found that caring for parents may decrease the women's employment. Family care work—including parent care—has been noticed in the world as a kind of unpaid household work. For example, the Beijing Platform for Action, adopted at the 1995 United Nations 4th World Conference on Women, called for member nations to take measures to recognize the value of unpaid family care work, reduce its burden, and encourage a more equitable distribution of unpaid family

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care work within the household (United Nations 1996). Goal 5 of the 2030 Sustainable Development Goals (SDGs) includes a target for recognizing and valuing unpaid family care work (United Nations 2015). Therefore, investigating the impact of parent care on women's employment has become an important issue for both developed and developing countries.

Chinese society has become an aging population and is facing the problem of a decreasing labor force; thus, increasing labor force participation has become an important issue for the Chinese government. This study investigates the influence of caring for parents on women's employment in China. Although some previous studies have analyzed the influences of child care on women' employment[1] and discussed unpaid work in China,[2] empirical studies on the impact of caring for parents on middle-aged women's employment are scarce. This study can address this neglected problem and provide new evidence on the issue from China.

The remainder of this chapter is as follows. Section 3.2 introduces the channels of the influence of parent care giving on the employment and summarizes previous empirical studies on the issue. Section 3.3 gives the framework of the empirical analysis, including models and datasets. Section 3.4 introduces the determinants of parent care giving and the influences of parent care on middle-aged women's employment. Section 3.5 summarizes the conclusions.

3.2 Literature Review

According to the economic theories, parent care may have both negative and positive effects on employment. First, based on the individual utility maximum model, an individual's labor supply is determined by the market wage and the work–leisure preference (e.g., reservation wage). Parent care can be considered a part of reservation wage that may increase the preference for leisure (non-work). Because a trade-off relationship between parent care and working hours remains, when a woman has to exit the labor market or reduce the working hours to care for parents even though she prefers to work, parent care may negatively affect her employment (negative effect). However, when a woman can pay for parent care service from the market, she may also choose to work, whereby she can earn more so as to pay for parent-care services or to charge care expenditures (positive effect). Because both the negative and positive effects remain, it is not clear how caring for parents affects the labor supply of middle-aged women. Empirical studies should be employed to investigate the relationship between parent care and middle-aged women's employment.

Second, numerous empirical studies for developed countries indicate that providing family care—including child care and parent care—reduces women' labor supply (Robar 1992; Lehrer 1992; Michalopoulos et al. 1992; Wolf and Soldo 1994; Çağatay et al. 1995; Wolf et al. 1997; Angrist and Evans 1998; Pezzin and Schone 1998; Carmichael and Charles 2003; Lilly et al. 2007; Leigh 2010; Viitanen 2010; Givord and Marbot 2015; Ho 2015; Skira 2015; Leken et al. 2017; Gathmann and Sass 2018).

Particularly, the influence of parent care giving on women's employment since the 1980s has been researched (Soldo and Myllyluoma 1983; Brody and Schoonover 1986). Lilly et al. (2007) summarized 35 papers on the issue for developed countries. Recently, numerous empirical studies have been undertaken; for example, Heitmueller (2007), Heitmueller and Inglis (2007) for the UK, Lilly et al. (2010, 2011) and Jacobs et al. (2014) for Canada, Meng (2011) for Germany, Casado-Marín et al. (2011) for Spain, Schneider et al. (2013) for Austria, and Nguyen and Connelly (2014) for Australia.

Most recent previous studies consider the endogeneity problem between parent care giving and women's employment. The previous studies can be divided into three types, based on the analysis method. First, some studies use parent care giving as an exogenous variable, but the results among these studies are not consistent. For example, Carmichael and Charles (2003a) found that family care reduces the probability of work participation. Lilly et al. (2010) found that family care reduces work participation, but its influence on work hours and wage is not significant. Second, some previous studies used cross-sectional survey data and instrumental variables (IV) methods to address the endogeneity problem. For example, Ettner (1995, 1996), Heitmueller (2007), and Bolin et al. (2008) used parents' age, parents' health status, number of siblings, and living parent dummy variables as the instrumental variables. Wolf and Soldo (1994) used the instrumental variables (IV) method and the reduced function method, respectively, to address the endogeneity problem. Third, some studies used panel data analysis methods, such as the fixed effects (FE) and random effects (RE) models, to address the endogeneity problem (Casado-Marín et al. 2011). Using fixed effects and instrumental variables methods (FE + IV), Van Houtven et al. (2013) found a remaining endogenous group for women. Most previous studies found that caring for parents may reduce the women' employment (Ettner 1995; Heitmueller 2007; Bolin et al. 2008; Van Houtven et al. 2013).

For China, using the data of the 2009 CHNS and IV-probit regression models, Chen and Fan (2015, 2016) indicated that caring for parents may reduce the women's employment. Using data from the CHNS from 1991–2011 and IV methods, Chen et al. (2016) found that caring for parents may reduce both the probability of participation in work and working hours of women aged 18–52, but the influence of caring for parents on the early retirement of women aged 45–49 is not significant. Using data from the China Health and Nutrition Survey (CHNS) from 1993–2011 and IV-probit and IV-tobit regression models, Wu et al. (2017) found that parent care giving may reduce the labor supply of both women and men. The instrumental variables used in these studies are the need of parent care and the number of siblings (Chen and Fan 2015, 2016; Chen et al. 2016; Wu et al. 2017).

Although these previous studies investigated the impact of parent care on women's employment, some remaining issues should be discussed as follows. First, no empirical study has focused on middle-aged Chinese women. As is well known, the probability of becoming ill is higher for older parents; therefore, the probability of parent care giving is higher for the middle-aged group. Regarding the influence of the public pension system, a woman can choose early retirement for parent care giving, which may decrease the labor force participation of middle-aged women. Therefore, from

both economics and policy perspectives, focusing on middle-aged women is important. Second, because conditions such as time constraints and pension eligibility age differ by groups, a heterogeneity problem may remain among different groups. Therefore, sensitivity checks for different groups should be employed. Although previous studies considered differences by population registration system (*hukou*) and education groups, differences by age and income have not been analyzed.

In contrast with previous studies, the main contributions of this study can be considered to be as follows. First, using a longitudinal survey data from the China Health and Retirement Longitudinal Survey (CHARLS), which focuses on individuals age 45 and older, this study chooses women aged 45–69, who give most of the care for older parents as the analyzed objects, to investigate the influence of parent care giving on women's work participation. Second, using subsamples of different groups, this study considers group heterogeneity and compares the influence of parent care by age (women aged 45–54, 50–54, 55–59, and 60–69), *hukou* (rural or urban), education (low-, middle-, and high-level education), and household income groups (low-, middle-, and high-income levels). Third, this study uses the IV method to address the endogeneity problem, as well as the random effects (RE) model to address the heterogeneity problem. These results may provide new insight regarding the issue.

3.3 Methodology and Data

3.3.1 Model

The probit regression model can be used to investigate the probability of work participation as Eq. (3.1).

$$Pr(Y_i = 1) = a_0 + \beta_{oPC} PC_i + \beta_{0X} X_i + v_i > 0 \tag{3.1}$$

In Eq. (3.1), $Pr(Y_i = 1)$ denotes the probability of work participation. i indicates individuals, PC is the dummy variable of parent care giving, and X represents the control variables. The influence of parent care giving on women's work participation is denoted by β_{0GC}, and the effect of each control variable is denoted by β_{0X}. In addition, a is a constant, and v_i is the error term.

In Eq. (3.1), two econometric problems should be considered. First, it is argued that an endogeneity problem may remain between the labor supply and parent care giving. For example, a woman can provide parent care because she retired early to care for a parent. To address the endogeneity problem, the IV method is used and is expressed as Eqs. (3.2)–(3.5).

$$Pr(PC_i = 1) = a_1 + \beta_{1Z} Z_i + \beta_{1X} X_i + u_i \tag{3.2}$$

$$Resi_i = PrPC_i - \widehat{PrPC}_i \tag{3.3}$$

$$Pr(Y_i = 1) = a_2 + \beta_{2PC}\widehat{PC}_i + \beta_{2X}X_i + \varepsilon_i \tag{3.4}$$

$$Pr(Y_i = 1) = a_2 + \beta_{2PC}PC_i + \beta_{2Resi}Resi_i + \beta_{2X}X_i + \varepsilon_i \tag{3.5}$$

$$corr(Z, \varepsilon) = 0 \text{ and } corr(Z, u) \neq 0$$

In Eqs. (3.3) and (3.4), β_{2PC} could be estimated by a two-step procedure: first, estimate Eq. (3.1), then predict $\widehat{PC}$ or residual items $Resi$ (Eq. 3.3) in the first step; and second, include $\widehat{PC}$ or residual items $Resi$ as explanatory variables and estimate Eq. (3.3) or (3.4) in the second step. Whether the estimates are unbiased hinges critically on the validity of the instrumental variables (Z); that is, Z needs to be correlated with PC while satisfying the conditions that $corr(Z, \varepsilon) = 0$. The IV methods include the two-stage least squares (2SLS), two-stage predictor substitution (2SPS), and two-stage residual inclusion (2SRI) models. The 2SRI model was advocated first by Hausman (1978), and then it was used by Blundell and Smith (1989). Newey (1987), Rivers and Vuong (1988), and Terza et al. (2008) pointed out that the SRI model can be used in binary variable analyses, and it can be considered to be an expansion of the 2SLS model for binary variable analyses. Because the dependent variable is a binary value (0 or 1), 2SPS and 2SRI models are used in the study, which are expressed by Eqs. (3.3) and (3.4), respectively.

Second, the heterogeneity problem may remain in Eq. (3.1). Concretely, v_i in Eq. (3.1) includes the unobserved individual-specific time-invariant effect μ_i and the true error δ_{it} ($v_{it} = \mu_i + \delta_{it}$). When the unobserved individual-specific time-invariant effect is not considered, the bias may exist in the results. To address the problem, the random effects (RE) model is used; it can by expressed by Eq. (3.6):

$$Pr(Y_{it} = 1) = a_3 + \beta_{3PC}PC_{it} + \beta_{3X}X_{it} + \mu_i + \delta_{it.} \tag{3.6}$$

Finally, to address the heterogeneity and other endogeneity problems simultaneously, the random effects model and the IV-2SRI model (RE + IV) are used.

We employ the Cragg-Donald Wald test to check the weak instrumental variables problem and calculate the Sargan statistic values to check the exogenous variables; we also employ the Durbin-Wu-Hausman test to determine whether the endogeneity problem remains between labor force participation and parent care giving. Then, we determine the validity of these models based on these test results.

3.3.2 Data

Data for this study come from the China Health and Retirement Longitudinal Survey (CHARLS). The CHARLS, which is conducted by Peking University every two years, covers representative regions of China. Its survey objects are individuals aged

45 and older. The baseline national wave of CHARLS, conducted in 2012, includes approximately 10,000 households and 17,708 individuals in 150 counties/districts and 450 villages/resident committees. The first and second follow-up survey waves were for 2014 and 2016. Information such as demographic characteristics, family structure, intra-household transfer, employment status, income, and other related facts can be obtained from the CHARLS. Because information about parent care can only be obtained from CHARLS 2011 and CHARLS 2013 data, this study uses data from these two waves. To consider the influence of the retirement system in government organizations and enterprises and public pension policies, the sample is limited to women from 45–69 years of age, including both rural and urban residents. Regarding the retirement system, we also analyzed various age groups (groups aged 45–49, 50–54, 55–59, and 60 and older) to check robustness.

3.3.3 Variables

Two dependent variables are constructed as follows: first, a binary variable is equal to 1 when a woman is caring for a parent and 0 when she is not. This variable is used in the first stage of the instrumental variable method. Second, a dummy variable is equal to 1 when a woman is working and 0 when she is not working.

The main independent variable is the dummy variable of parent care giving, which is equal to 1 when a woman is a parent care giver and 0 when she is not.

Different covariates are used to control other influences on women's participation in the labor force. First, according to the human capital theory (Becker 1964; Mincer 1974), an individual's wage level is determined by human capital, such as education and years of experience. As Grossman (1972) pointed out, health status is also a kind of human capital. It can be thought that these factors are the important determinants of the labor supply. On the other hand, educational attainment may also influence people's attitudes toward work and family care. This study uses educational attainment levels (low, middle, and high educational levels),[3] age dummy variables,[4] and subjective health status[5] as the proxy variables of human capital.

Second, Douglas (1934) and Arisawa (1956) indicated that women's labor supply is influenced not only by the market wage but also by unearned income, such as the income of the husband and other family members. Annual household consumption is used as the index of household income. The dummy variable of having a spouse is constructed to control the influence of family members on the labor supply.

Third, based on the labor market segmentation hypothesis (Piore 1970), workers' behaviors are shaped by the characteristics of the labor market. As is well known, in China, the labor market is segmented by the population registration system (*hukou*) (Ma 2018). Since 1958, the *Hukou* system has been implemented by the government. In the planned economy period (1949–1977), migration from rural to urban areas was prohibited. During the market-oriented economy reform period since the 1978, the *Hukou* system has been deregulated, but great differences in employment and wages remain between the rural *hukou* and urban *hukou* residents. For example, social

security systems (e.g., public pension, medical insurance schemes) differ according to the *Hukou* system. Therefore, an urban resident dummy variable is used to control the influence of labor market segmentation by the *hukou* system.

Fourth, two variables are constructed as instrumental variables. (1) The number of parents living can affect the probability of parent care giving; the more parents who are living, the higher the probability of parent care giving will be. (2) The number of siblings may affect the probability of parent care giving. It is assumed that the probability of parent care giving may be smaller for a woman with more siblings because parent care giving can be shared among siblings. It can be considered that the influnences of these two variables on work participation of middle-aged and older women are small. The number of parents living and number of siblings are used as the instrumental variables in this study.

Finally, the culture and the economic development level may change by years; the year dummy variables (2011, 2013) are included in the control variables. Table 3.1 presents descriptive statistics of the variables of women aged 45–69. First, the proportion of women caring for a parent is 13.7%; one of seven women aged 45–69 in China care for a parent. Second, as compared with the employment rate between the care-giving and non-care-giving groups, it is generally 6.6% lower for the care-giving group than for the non-care-giving group. Third, individual characteristics differ between the care-giving group and the non-care-giving group. Concretely, it is shown that the proportions of groups that are well-educated, healthy, have a spouse, are urban residents, are younger, and have high-income households are greater for the care-giving group, whereas the number of children is slightly less for the care-giving group. The individual characteristics of care-giving and non-care-giving groups are shown to differ; these factors should be controlled when investigating the influence of parent care giving on women's employment.

3.4 Results

3.4.1 Determinants of Women's Parent Care Giving

Table 3.2 summarizes the determinants of parent care giving. The probit regression model based on the cross-sectional data (Model 1) and the random effects (RE) probit model based on the panel data are used (Model 2). The main findings are as follows.

First, in the initial stage of the IV method, the coefficients of both the number of parents living and the number of sibling dummy variables are statistically significant at 1 and 5% levels in both Model 1 and Model 2. Based on the results of Model 2, when the number of parents living increases by one, the probability of parent care giving may increase by 61.9% points; as compared with the group with four or more siblings, the probability of giving parent care may decrease by 19.1% points for the group with one sibling; however, the differences in probability between groups

Table 3.1 Descriptive statistics of variables

	Total		Care giving (a)		Non-care giving (b)		D
	Mean	S.D.	Mean	S.D.	Mean	S.D.	a–b
Labor participation	0.702	0.457	0.759	0.428	0.693	0.461	0.066
Parent care	0.137	0.344					
Education							
Low-education	0.899	0.301	0.797	0.402	0.915	0.279	−0.118
Middle-education	0.087	0.282	0.167	0.373	0.074	0.262	0.093
High-education	0.014	0.118	0.036	0.187	0.010	0.102	0.026
Age	55.817	6.828	51.921	5.547	56.437	6.808	−4.516
Health status							
Poor	0.257	0.437	0.184	0.387	0.268	0.443	−0.084
Fair	0.512	0.500	0.536	0.499	0.508	0.500	0.028
Good	0.136	0.343	0.161	0.368	0.132	0.338	0.029
Very good	0.085	0.279	0.108	0.310	0.082	0.274	0.026
Excellent	0.011	0.102	0.012	0.108	0.010	0.101	0.002
Having spouse	0.913	0.282	0.945	0.228	0.908	0.289	0.037
Number of children	2.462	1.242	2.022	1.022	2.532	1.259	−0.510
Urban	0.201	0.401	0.287	0.453	0.188	0.391	0.099
Household income	8.778	0.888	8.957	0.916	8.749	0.880	0.208
Number of living parent	0.509	0.688	1.047	0.643	0.423	0.656	0.624
Survey year							
y2011	0.425	0.494	0.457	0.498	0.420	0.494	0.037
y2013	0.575	0.494	0.543	0.498	0.580	0.494	−0.037
Observation	8,656		1,187		7,449		

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

without sibling, the group with two or three siblings, and the group with four and more siblings are small.

Second, for the influence of other factors, based on the results of Model 2, (1) the probabilities of caring for parents are 29.9% and 27.1% points higher for middle and high education level groups, respectively, than for the low-education level group.

(2) The probability becomes greater with age. Concretely, as compared with women in the group aged 45–49, the probabilities of giving parent care are 35.4% and 59.4% points higher for groups where the women were aged 55–59 and 60–69, respectively. The difference in the probability of parent care giving for women aged 45–49 and 50–54 is small.

(3) As compared with the group with very poor health, the probability of caring for grandchildren is 12.1%, 12.1%, and 14.3% points higher for the fair, good, and

Table 3.2 Determinants of women's parent care giving

	(1) Probit		(2) RE probit	
	dy/dx	z-value	dy/dx	z-value
Education (*low*)				
Middle-education	0.051***	4.09	0.299***	3.96
High-education	0.051*	1.88	0.271*	1.68
Age (*age 45–49*)				
Age 50–54	−0.005	−0.57	−0.041	−0.72
Age 55–59	−0.047***	−5.59	−0.354***	−5.49
Age 60–69	−0.079***	−8.29	−0.594***	−7.89
Health status (*poor*)				
Fair	0.018**	2.17	0.121**	2.13
Good	0.020*	1.72	0.121*	1.61
Very good	0.022	1.60	0.143*	1.67
Excellent	0.027	0.81	0.150	0.75
Having spouse	0.012	0.92	0.089	0.97
Children number	−0.011***	−3.17	−0.071***	−3.10
Income	0.009**	2.34	0.063**	2.33
Urban	0.022**	2.35	0.139**	2.24
Number of living parent	0.094***	19.95	0.619***	16.03
Number of siblings (*four and more*)				
No sibling	−0.001	−0.04	−0.017	−0.13
One	−0.025**	−1.97	−0.191**	−2.04
Two	0.006	0.55	0.031	0.46
Three	0.006	0.77	0.043	0.78
Survey year (*y2011*)				
y2013	−0.022***	−3.20	−0.146***	−3.33
Number of obs.	8,656		8,656	
Number of groups			6,635	
Likelihood-ratio test of rho = 0			chibar2(01) = 27.88	
Pseudo R_2	0.151			
Prob ≥ chi2(chibar2)	0.000		0.000	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

very good health groups, respectively. This indicates that health status positively affects the probability of caring for a parent.

(4) The number of children negatively influences the probability of giving parent care. When the number of children increases by one child, the probability of giving parent care decreases by 7.1% points. Because the time constraint remains, when the other time is consistent, a trade-off relationship exists between child care and parent care. Hours of housework may be greater for women with more children, which may decrease the time available to care for parents.

(5) Household income positively affects the probability of giving parent care. A woman in a high-income household may not need to work for a living; therefore, she may have more leisure hours to devote to parent care.

(6) The probability of giving parent care is 13.9% points higher for urban *hukou* women than for rural *hukou* women.

The results can be considered as follows. First, in rural areas, the influence of Confucianism is greater. Based on the culture in rural areas, the objects of parent care are mainly a woman's parents in law. However, in urban areas, a woman can care for both her parents and parents in law. In addition, the consciousness of intra-household or community risk sharing is more significant in rural areas than in urban areas. Therefore, parent care giving can be shared by other family members or the community in rural areas. Second, as mentioned above, depending on the public pension scheme covering employees in government organizations and firms—most of which are urban *hukou* workers—the mandatory retirement age is 50 for female workers and 55 for female cadres; most retired urban *hukou* workers can obtain pension benefits from the Urban Employee Pension Insurance scheme (UEPI) and most urban residents who are not coverved by the UEPI can obtain pension benefit from the Urban Residents Pension Insurance (URPI). In rural areas, based on the New Rural Pension Scheme (NRPS), women aged 60 and over can receive pension benefits when an adult family member has participated in the NRPS. However, the pension benefit is less for rural *hukou* residents than for urban *hukou* residents.[6] It can be assumed that rural women may have to work for a living. Thus, the probability of giving parent care is higher for urban women than for rural women.

The results indicate that the number of parents living, number of siblings, and individual characteristics such as education, age, health status, family structure (number of children, household income), and labor market segmentation factors (urban or rural areas) may influence the probability of caring for a parent.

3.4.2 Parent Care Giving and Women's Employment

Table 3.3 displays the results using the total samples of women and men. We summarize the results of the probit regression model (Model 1), IV-2SPS (Model 2), IV-2SRI (Model 3), random effects (RE) probit regression model (Model 4), and RE and IV-2SRI model (Model 5). We use the number of parents living and number of siblings as the instrumental variables for the endogenous variable of parent care

Table 3.3 Parent care giving and employment of women aged 45–69 years

	(1) Probit		(2) IV (2SPS)		(3) IV (2SRI)		(4) RE		(5) RE and IV(2SRI)	
	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
Parent care	0.046***	2.98	0.225***	3.73	0.190***	3.80	0.202**	2.51	1.356***	4.07
Education (*low*)										
Middle-education	−0.019	−0.96	−0.036*	−1.78	−0.036*	−1.78	−0.136	−1.29	−0.240**	−2.16
High-education	0.185***	5.41	0.176***	4.90	0.175	4.89	1.229***	4.82	1.119***	4.27
Age (*age 45–49*)										
Age 50–54	−0.125***	−7.23	−0.112***	−6.35	−0.112***	−6.37	−0.567***	−6.67	−0.499***	−5.73
Age 55–59	−0.180***	−10.8	−0.157***	−8.62	−0.156***	−8.59	−0.870***	−9.79	−0.740***	−7.78
Age 60–69	−0.275***	−16.9	−0.237***	−12.30	−0.237***	−12.29	−1.319***	−13.83	−1.110***	−10.49
Health status (*very poor*)										
Fair	0.098***	8.11	0.094***	7.71	0.094***	7.70	0.452***	7.20	0.430***	6.76
Good	0.111***	7.01	0.105***	6.57	0.105***	6.56	0.555***	6.24	0.521***	5.78
Very good	0.098***	5.27	0.092***	4.87	0.092***	4.86	0.483***	4.67	0.446***	4.25
Excellent	0.077*	1.63	0.074	1.56	0.075	1.57	0.381	1.47	0.367	1.41
Having spouse	0.076***	4.18	0.072***	3.96	0.072***	3.96	0.368***	3.91	0.349***	3.65
Children number	−0.002	−0.54	−0.001	−0.29	−0.001	−0.26	−0.008	−0.34	0.001	0.05
Urban	−0.398***	−25.93	−0.403***	−25.84	−0.404***	−25.86	−1.824***	−17.96	−1.867***	−17.79
Income	−0.048***	−7.84	−0.051***	−8.14	−0.051***	−8.16	−0.202***	−6.33	−0.217***	−6.70
Residual items					−0.193***	−3.12			−1.215***	−3.58
Survey year (*2011*)										
y2013	0.040***	3.76	0.045***	4.18	0.045***	4.17	0.171***	3.59	0.200***	4.10

(continued)

Table 3.3 (continued)

	(1) Probit		(2) IV (2SPS)		(3) IV (2SRI)		(4) RE		(5) RE and IV(2SRI)	
	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value	Coef.	z-value
Number of obs.	8,555		8,555		8,555		8,555		8,555	
Number of groups							6,597		6,546	
Likelihood-ratio test of rho = 0							chibar2(01) = 321.92		chibar2(01) = 322.19	
Prob ≥ chibar2							0.000		0.000	
Pseudo R_2	0.147		0.146		0.146					
Prob ≥ chi2	0.000		0.000		0.000					
Cragg-Donald Wald F-test			103.58 (P = 0.000)		185.54 (P = 0.000)				280.46 (P = 0.000)	
Sargan statistic			3.776 (P = 0.437)		3.985 (P = 0.408)				4.986 (P = 0.336)	
Durbin-Wu-Hausman			1.535 (P = 0.215)		31.869 (P = 0.000)				34.824 (P = 0.000)	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Probit regression models are used. 2SPS: two-stage predictor substitution instrumental variables methods; 2SRI: two-stage residual inclusion instrumental variables methods; RE: random effects model

giving in the first stage estimation, which is shown in Table 3.2. The values of the Cragg-Donald Wald F-test are 103.57, 185.54, and 280.46 for IV-2SPS (Model 2), IV-2SRI (Model 3), and RE and IV-2SRI (Model 5) models, respectively, which are larger than the standard value of 10 and statistically significant at the 1% level. The results indicate that these are not weak instrumental variables. The results of the Durbin-Wu-Hausman test show that giving parent care is an endogenous variable in the probability of the labor force participation function. The Sargan statistic values suggest that the instrumental variables in the first stage are exogenous. These results indicate that the instrumental variables are valid, and the IV method should be used in estimations. The main findings are summarized as follows.

First, the probability of employment is 4.6–135.6% points higher for parent care giver group. In addition, when considering the heterogeneity and other endogeneity problem, the influence of parent care giving on the employment of women aged 45–69 years becomes greater. When these problems are not addressed, the results of the influence of parent care may be underestimated.

Second, other factors influence the employment of middle-aged women. Concretely, based on the results of Model 5 (RE and IV-2SRI model), (1) to compare with the group with low-level educations, the probability of work participation is lower for the mid-level educational group, but is higher for the high-level educational group. It is shown that U-shaped relationship exists between education and the employment of women aged 45–69.

The reason is thought to be as follows. Women with low-level educations have to work for a living, due to their lower household income; therefore, the probability of participation in work is higher for the low-level education group than for the mid-level education group. Because market wages are higher for the highly educated group, the probability of work participation may be higher for the high-level education group than for the low- and mid-level education groups.

Third, the probability of participation in work is higher for women aged 45–49 than for women aged 50 and older. This is related to the mandatory retirement system in government organizations and firms. Most women retire at 50 and 55 years; therefore, the probability of work participation may decrease dramatically for the group aged 50 and older.

Fourth, the probability of participation in work is higher for the healthy group than for the poor health group. As one kind of human capital, health status may affect the employment of middle-aged and older women. The health results are consistent with those of previous studies.

Fifth, the probability of participation in work is higher for women with a spouse (the married women group) than for single women.

Sixth, household income negatively affects women's work participation. Based on the individual utility model, unearned income, such as the household income of other family members, may increase the preference for leisure; therefore, the probability of work participation is lower for women in high-income households than for those in low-income households.

Seventh, the probability of participation in work is lower for urban women than for rural women. These results can be explained as follows. Because the public pension

benefit is higher for urban women than for rural women, most urban women can maintain their living standard by receiving public pension benefits after they retire, while most rural women must continue working for a living. In addition, most urban women are employees, and the proportion of workers whose ages are older than the mandatory retirement age is small in firms, which may be caused by the reasons of both labor supply and labor demand sides. From the labor demand perspective, although urban women may wish to work after retirement, the labor demand for older workers in firms is low in urban areas. On the contrary, in rural areas, most women work in the agricultural industry and are self-employed, so they can adjust their own work. Thus the labor demand for rural women may not change greatly in the middle-aged group and older group. In additions, from the labor supply perspective, the public pension benefit is higher for urban residents than rural residents, the higher pension benefits may rise the reservation wage level for urban women.

3.4.3 Sensitivity and Robustness Checks: Results for Different Groups

To consider the heterogeneity of different groups, we employ estimations using the RE or RE_IV-2SRI probit regression models by age, area (urban and rural), education, and household income groups. The validity model used is based on the likelihood-ratio test of $\rho = 0$, the Cragg-Donald Wald F-test, the Sargan statistic test, and the Durbin-Wu-Hausman test. The marginal values (dy/dx) of the parent care giving dummy variable and estimated residual items are summarized in Tables 3.4, 3.5, 3.6, 3.7. The main results are as follows:

First, the results of Table 3.4 show that the influence of parent care giving on employment is greater for women aged 50–59 than for women aged 45–49, and all values are positive. This suggests that to compare women aged 45–49 with women aged 50–59, the positive effects of parent care giving on employment are greater than the negative effects. This indicates that women aged 50–59 seem likely to participate in work to obtain higher incomes for living or to pay for parent care.

Second, the difference in the influence of parent care giving on employment is small between the urban *hukou* and rural *hukou* groups, and the influence is positive for both urban (1.313) and rural women (1.003) (see Table 3.5). It indicates that either the urban *hukou* group or the rural *hukou* group has to work to obtain more income from the labor market, therefore the problems of family-work conflict might maintain for both the rural and the urban residents.

Third, the probability of employment is higher for the mid-level and highly educated groups (1.732) than for the low-level education group (1.083) (see Table 3.6). These results can be explained by the human capital theory (Becker 1964; Mincer 1974). Well-educated individuals can obtain higher wages from the labor market when the reservation wage and work or leisure preference are constant; based on the individual utility maximum model, the probability of employment may

Table 3.4 Parent care and employment of women aged 45–69 by age

	(1)Age 45–49		(2) Age 50–54		(3) Age 55–59		(4) Age 60–69	
	RE		RE and IV(2SRI)		RE and IV(2SRI)		RE	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Parent care	0.378**	2.24	1.087*	0.076	3.073**	1.97	0.234	1.12
Control variables	Yes		Yes		Yes		Yes	
Number of obs.	2,131		1,666		1,987		2,790	
Number of groups	1,800		1,471		1,700		6,422	
Likelihood-ratio test of rho = 0	chibar2(01) = 55.61		chibar2(01) = 36.49		chibar2(01) = 52.87		chibar2(01) = 26.36	
Prob ≥ chi2(chibar2)	0.000		0.000		0.000		0.000	
Cragg-Donald Wald F-test	16.952 (P = 0.000)		652.340 (P = 0.000)		450.836 (P = 0.000)		213.815 (P = 0.000)	
Sargan statistic	7.166 (p = 0.1274)		8.918 (p = 0.063)		1.205 (p = 0.877)		1.904 (p = 0.754)	
Durbin-Wu-Hausman	0.304 (p = 0.581)		4.272 (p = 0.039)		6.332 (p = 0.012)		0.576 (p = 0.448)	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Education, marital status, health status, income, urban/rural status, and survey year variables are estimated. They are not expressed in this table

(3) Probit regression models are used. 2SRI: two-stage residual inclusion instrumental variables method; RE: random effects model

Table 3.5 Parent care and employment of women aged 45–69 by urban *hukou* and rural *hukou*

	(1) Urban		(2) Rural	
	RE and IV(2SRI)		RE and IV(2SRI)	
	dy/dx	z-value	dy/dx	z-value
Parent care	1.313**	2.13	1.003**	2.48
Control variables	Yes		Yes	
Number of obs.	6,335		5,850	
Number of groups	4,903		4,564	
Prob ≥ chi2 (chibar2)	0.000		0.000	
Cragg-Donald Wald F-test	349.668 (P = 0.000)		620.356 (P = 0.000)	
Sargan statistic	6.980 (p = 0.137)		1.902 (p = 0.754)	
Durbin-Wu-Hausman	39.838 (p = 0.000)		15.863 (p = 0.000)	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Education, age, marital status, health status, income, and survey year variables are estimated. They are not expressed in this table

(3) Probit regression models are used. 2SRI: two-stage residual inclusion instrumental variables method; RE: random effects model

Table 3.6 Parent care and employment of women aged 45–69 by education

	(1) Low		(2) Middle and high	
	RE and IV(2SRI)		RE and IV(2SRI)	
	dy/dx	z-value	dy/dx	z-value
Parent care	1.083***	2.87	1.732**	2.32
Control variables	Yes		Yes	
Number of obs.	7,690		865	
Number of groups	5,876		670	
Likelihood-ratio test of rho = 0	chibar2(01) = 282.44		chibar2(01) = 32.53	
Prob ≥ chi2(chibar2)	0.000		0.000	
Cragg-Donald Wald F-test	150.662 (P = 0.000)		833.660 (P = 0.000)	
Sargan statistic	2.402 (P = 0.662)		6.663 (P = 0.155)	
Durbin-Wu-Hausman	38.174 (p = 0.000)		21.044 (p = 0.000)	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Age, marital status, health status, income, and survey year variables are estimated. They are not expressed in this table

(3) Probit regression models are used. 2SRI: two-stage residual inclusion instrumental variables method; RE: random effects model

Table 3.7 Parent care and employment of women aged 45–69 by household income

	(1) Low-income		(2) Middle-income		(3) High-income	
	RE		RE and IV(2SRI)		RE and IV(2SRI)	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Parent care	0.415**	2.11	1.214	1.95	1.214	1.95
Control variables	Yes		Yes		Yes	
Number of obs.	2,665		2,876		3,034	
Number of groups	2,331		2,624		2,624	
Likelihood-ratio test of rho = 0	chibar2(01) = 56.13		chibar2(01) = 32.53		chibar2(01) = 41.86	
Prob ≥ chi2(chibar2)	0.000		0.000		0.000	
Cragg-Donald Wald F-test	424.373 (P = 0.000)		537.265 (P = 0.000)		593.265 (P = 0.000)	
Sargan statistic	1.229 (P = 0.873)		5.068 (P = 0.280)		5.563 (P = 0.234)	
Durbin-Wu-Hausman	2.366 (p = 0.124)		4.048 (p = 0.044)		24.172 (p = 0.000)	

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

Notes (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Age of samples is from 45–59. (2) Education, age, marital status, health status, urban/rural status, and survey year variables are estimated. They are not expressed in this table

(3) Probit regression models are used. 2SRI: two-stage residual inclusion instrumental variables method; RE: random effects model

be higher for well-educated women (positive effect). On the contrary, well-educated women may obtain more pension benefits than less-educated women, and increasing unearned income may decrease the probability of employment for well-educated women aged 45–69 (negative effect). The estimated results suggest that the positive effect is greater than the negative effect for well-educated women.

Fourth, the influences of parent care on employment are not statistically significant for both middle-income and high-income groups, whereas parent care positively affects the probability for the low-income group (Table 3.7). It might be caused by that an individual in the low-income group has to work for living for living or to pay for parent care. In the sense, the problem of family-work conflict might be severe for the low-income group than the middle- and high-income groups in China.

3.5 Conclusions

Using the longitudinal survey data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011–2013, this study investigates the influence of parent care giving on employment of women aged 45–69 in China. The random effects (RE) model and instrumental variables (IV) methods are used to address the unobserved

heterogeneity and other endogeneity problems, respectively. The main findings are as follows.

First, the number of parents living, number of siblings, and individual characteristics such as education, age, health status, family structure (number of children, household income), and labor market segmentation factors (urban or rural areas) may influence the probability of parent care giving for middle-aged and older women.

Second, although the results of previous studies using younger and middle-aged women (i.e., women aged 18–52) indicated that parent care giving negatively affects women's employment, this study focused on middle-aged and older women aged 45–69 and found that the probability of employment is higher for the group caring for parents. This can be explained by the fact that the positive effect (income effect) is higher than the negative effect (time constraint effect).

Third, the influences of caring for parents on women's employment differ by group. Concretely, the influence is greater for women aged 50–59, those who are well-educated, and low-income women than for their counterparts. In the sense, the problem of family-work conflict by the parent care might be severe for these groups.

The policy implications of these results can be considered to be as follows. First, although middle-aged and older women can choose to exit the labor market to live depending on the public pension benefit and past savings, most women who are caring for parents chose to work. It is assumed that these parent care givers must work to earn a living because the pension benefits are lower or they are trying to obtain more income from the labor market for living or to pay for parent care. This suggests that the work–family conflict caused by the parent care among the middle-aged and the older women may remain. To address the problem, elderly care insurance policies should be considered. The case in Japan, where a care insurance system was implemented in 2000, shows that implementing a care insurance system positively affects the labor supply of Japanese women (Shimizutani et al. 2004). The Chinese government may learn from the experience of developed countries to establish a care insurance system in the future. Second, the results show that low-income women are likely to have to work. This suggests that income inequality may cause differences in the labor force participation of middle-aged and older women; poor women must work endlessly, which may cause the gaps of work status in lifespan among groups of women. To address the problem, income inequality should be considered in the care insurance system. For example, the contribution of care insurance should be paid based on wage or income levels, and basic care service should be equal for low-income and high-income groups.

Notes

1. For empirical studies on the child care on women's employment in China, please refer to Shen et al. (2012); and Liu et al. (2016).
2. For the latest paper on the summary and discussion on family care in China, please refer to Connelly et al. (2018).
3. Low education includes those with no formal education, those who did not finish primary school, those who were home schooled, and those who completed

elementary school; middle education includes those with junior high school, senior high school, or vocational school educations; high education includes those with college, university, or graduate school educations.
4. The age dummy variables include those 45–49, 50–54, 55–59, and 60–69 years of age.
5. Based on the CHARLS questionnaire, five kinds of dummy variables (excellent, very good, good, fair, and poor) were constructed.
6. For example, based on the data from CHARLS2015, the average annual public pension benefit is 27,543 CNY for urban residents and 2,705 CNY for rural residents.

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Part II
The Gender Gap in China's Labor Market and Society

Chapter 4
Ownership Sector and the Gender Wage Gap

Abstract Using data of the Chinese Household Income Project surveys (CHIP), this study explores the determinants of the gender wage gap by five kinds of ownership sectors from 2002 to 2013 in urban China. A decomposition analysis of the gender wage gap based on the Blinder-Oaxaca decomposition model is employed. The results show that the gender difference in human capital and discrimination against female workers contribute to the gender wage gap; the influence of the unexplained component including the discrimination against female workers increased in each ownership sector from 2002 to 2013. The range of the increase in the influence of the unexplained component is greater for firms in the public sector than for those in the private sector; and the influence of factors on the gender wage gap differs by ownership sector.

Keywords Ownership · Gender wage gap · Human capital · Discrimination · China

4.1 Introduction

With the progress of market-oriented economy reform in China, income inequality has expanded and become a serious social problem. There have been many studies on the issue, such as those of Zhao et al. (1996; Li et al. (2008, 2013, 2017) and Sicular et al. (2020). Because wages are the largest share of local urban residents' income, a study of wage gaps is undoubtedly of great significance to income inequality. Currently, there are a variety of wage gaps in China. Of these, the gender wage gap has risen to prominence.

Under the market-oriented economy reform period from 1978 to the present, the gender wage gap has become an important issue in China. First, the widening gender wage gap contributes to greater income inequality. Second, the gender wage gap has expanded[1] (Gustafsson and Li 2000; Li et al. 2011; Ma 2009a, 2009b, 2011, 2018a). The gender wage gap was small during the planned economy period because the government focused more on gender equality and carried out a number of positive policies to promote female employment and gender equality. These policies contributed to reducing the gender wage gap (Gustafsson and Li 2000; Liu et al. 2000;

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Maurer-Fazio and Hughes 2002; Ma 2018a, 2018c). Conversely, market-oriented economy reform had a disastrous effect on the gender wage gap. It is assumed that the influence of market mechanisms on wage determination may become greater with the growth of the private sector (e.g., domestic privately owned enterprises, foreign-owned enterprises, or the self-employed sector). Most of the wage determination and employment systems in the public sector (government organizations, state-owned enterprises) are still controlled by the government, whereas the influence of market mechanism on wage determination is greater in the private sector. Therefore the labor market in urban China is segmented into the public sector and the private sector (Chen et al. 2005; Demurger et al. 2007, 2012; Zhang and Xue 2008; Ye et al. 2011; Ma 2014, 2018a, 2018b, 2018c). When the wage determination mechanism differs by ownership types, the gender wage gap may vary in different ownership sectors.

Although some empirical studies have investigated the determinants of gender wage gaps, empirical studies of detailed decomposition by different ownership sectors on the gender wage gap are scarce, particularly, regarding how these factors changed as the market-oriented economy reform progressed in the 2000s. This study utilizes data from two periods of the Chinese Household Income Project survey (CHIPs) conducted in 2003 and 2014 (CHIPs 2002, CHIPs 2013) to provide empirical evidence about determinants of the gender wage gap by different ownership sectors (e.g., government organizations; state-owned enterprises: SOEs; collectively owned enterprises: COEs; privately owned enterprises: POEs; foreign-owned enterprises: FOEs; self-employed) and its change from 2002 to 2013 in urban China.

This chapter is structured as follows. Section 4.2 introduces the background of labor market reform and the changing gender gap in China. Section 4.3 summarizes the economic theory of discrimination in the labor market and previous empirical studies. Section 4.4 describes the methods of analysis, including an introduction to the models and data. Section 4.5 gives the calculated results, and Sect. 4.6 states and interprets the econometric results. Section 4.7 presents the main conclusions.

4.2 Changes in the Gender Wage Gap in Urban China During the Economic Transition Period

In the planned economy period, the government enforced a "socialism reconstruction" campaign. By the 1960s, all POEs and FOEs were reformed into SOEs or COEs, comprising the "the public sector" (*Gongyouzhi Bumen*). In the public sector, the Chinese government controlled the number of workers and wage levels and implemented the long-term employment system and the seniority wage system. In order to enforce the communist ideology, the government implemented policies to promote female employment and gender equality. Because the government controlled employment and wage determination, although wage level determination and promotion did not obey market mechanisms, wage distribution was relatively equal, and the gender

gap in employment and wages was small in urban China (Gustafsson and Li 2000; Liu et al. 2000; Maurer-Fazio and Hughes 2002; Ma 2011, 2018a, 2018c).

Conversely, market-oriented economy reform had an indirect effect on the expansion of the gender wage gap. For example, 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 female to male wages) in urban regions increased from 77.5% (1990) to 63.7% (2010). How did the market-oriented economy reform affect the gender wage gap in China? Three key factors are discussed as follows.

First, SOE reform may have affected the gender wage gap. The government has been implementing SOE reform since the 1980s. This reform allowed most SOEs to gain a bit of management authority: they could decide the wage level and individual bonuses based on the firm's total wage bills. The government determined the firm's total wage bills based on the production plan set by agreement in the prior year. A firm could reserve a portion that was more than the production plan as a firm's reserved saving; the reserved firm's saving could be used to pay workers' bonuses. The reform motivated state-owned enterprises to increase productivity; therefore, SOEs were motivated to pay more to a highly productive worker (highly skilled, or highly educated worker). Thus, when labor productivity is higher for the male group than for the female group, the gender wage gap may increase with the SOE reform.

In addition, starting in 1986, the long-term employment system was replaced by the labor contract system in SOEs, and the employment system reform in SOEs was enforced from the late 1990s. It was found that the risk of retrenchment was higher and reemployment rates lower for the female group (Knight and Li 2006; Ma 2008). The average wage of re-employed workers was lower for the female group than for the male group in SOEs (Appleton et al. 2002; Knight and Li 2006; Ma 2008). The probability of becoming unemployed differed significantly for males and females. This may be a contributory cause of the decreased female labor force participation rate.[2]

Moreover, starting in the 1980s, a section of small and mid-sized SOEs and COEs changed their ownership types to POEs. The SOE reform and the increase in privately owned enterprises may affect the gender wage gap in urban China.

Second, from the 1980s, the government implemented an Opening-up policy. China joined the WTO in 2001, this led to a significant increase in FOEs. In addition, POEs and self-employment has been permitted by the government since the 1990s. Because a firm in the private sector (e.g., FOEs, domestic POEs, self-employed sector) faces a competitive market, it determines wages based on market mechanisms, which means wages are determined by workers' marginal labor productivity. The competitive market should decrease discrimination against female workers. However, because an employer in the private sector can determine workers' wages by himself (herself), it is possible for discrimination against female workers to occur more easily in the private sector than in the public sector. Although some empirical studies have shown that the gender wage gap in the public and private sectors differs, the results are not consistent. For example, Ma (2009b) utilized CHIPs 1995 and CHIPs 2002 survey data for an empirical study that showed that, in all ownership sectors, the gender wage gap expanded from 1995 to 2002; the gender wage gap was greater in

the POEs than in SOEs in 2002. In contrast, Guo and Zhang (2010) utilized Labor Survey data from 2006 for the Northeast region to analyze the gender wage gap in the public sector and the private sector; they argued that the gender wage gap is greater in the public sector than in the private sector. Thus, a more-detailed empirical study about ownership sectors and the gender wage gap is needed.

Third, in order to address the gender wage gap in labor markets, the Chinese government introduced a number of new policies and regulations during the market-oriented reform period. For example, the central government implemented a compulsory education policy and increased public education subsidies to poorer rural areas. These policies may reduce the gender gap for education, considered to be "the discrimination before entry to the labor market." Based on data from the third CFSSS, the gender gap of years of schooling decreased from 1.9 years in 1990 (male 6.6 years, female 4.7 years) to 0.3 years in 2010 (male 9.1 years, female 8.8 years). The Labor Law (*Laodong Fa*) was published in 1995, and the Labor Contact Policy (*Laodong Hetong Fa*) was promulgated in 2008; these labor policies protect the rights of both males and females and promote equality of employment and wages for both males and females. Local government also promulgated policy to promote the equality of employment and wages between these two groups. For example, Shenzhen City (in Guangdong Province) implemented a policy called the "Gender Equality Promotion Law in the Economy Special Zone" in June 2012, which is the first government law for gender equality in China. These positive policies may affect the gender wage gap in China.

4.3 Literature Review

4.3.1 General Economic Theories to Explain the Determinants of the Gender Wage Gap

What causes the gender wage gap in the labor market? First, based on the discrimination hypothesis (Becker 1957), discrimination against female workers may be shown by employers, customers, and colleagues; this discrimination causes the gender wage gap. To consider the situation in China, it is assumed that as compared with the public sector, an employer's influence on employees' wage determination is greater in the private sector; if employer discrimination is severe in the private sector, the gender wage gap may be higher in the private sector than in the public sector.

Second, the statistical discrimination hypothesis (Arrow 1972, 1973; Phelps 1972) states that because an employer cannot have perfect information about employees, he makes decisions on employment and wages for a male worker or a female worker based on the average values of some factors that are not presently observed (work effort, probability of turnover). When the employer predicts that the probability of taking housework (e.g., child care, family care, home cleaning, cooking) is higher

for females than males, he may reduce their employment and set a lower wage level for females.

Third, based on the human capital theory (Becker 1964; Mincer 1974), in a perfectly competitive labor market, the individual wage level is determined by a worker's labor productivity, which is related to a worker's human capital; thus when a worker with higher level of human capital (e.g., higher education level, longer tenure years, or more years of experience[3]), he/she should earn a higher wage. Because foreign-owned enterprises and privately owned enterprises operate in a competitive market, they determine wages based on market mechanisms, which means that a worker's wage is determined by his/her productivity. Thus, when the human capital factors are held constant, the gender wage gap may be lower in the private sector than in the public sector.

Fourth, the labor market segmentation hypothesis also can explain the existence of gender wage gaps. For example, Piore (1970) suggested that the labor market is not a perfect competitive market; it 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, when males concentrate in the primary market (e.g., the public sector), while females concentrate in the secondary market (e.g., the private sector), the gender wage gap appears.

Fifth, based on the crowded hypothesis (Bergmann 1974), the labor market is segmented by female-dominated occupations and male-dominated occupations (e.g., manager, professional engineer); the proportion of women in female-dominated occupations (e.g., beautician, clerical staff) is greater, whereas the proportion of men in male-dominated occupations is greater. For this reason, when the wage level in male-dominated occupations is higher than that in female-dominated occupations, gender wage gaps will appear. This is called "the influence of occupational segregation on the gender wage gap" (Bergmann 1974).

As described above, based on these economic hypotheses and theory (the discrimination hypothesis; statistical discrimination hypothesis; human capital theory; primary and secondary labor market segmentation hypothesis; crowd hypothesis), the prediction results for the gender wage gaps in the public sector or the private sector are not clear. An empirical study is needed to provide evidence for analysis.

4.3.2 Summary of Empirical Studies on the Gender Wage Gap in China

For the empirical studies on the gender wage gap in urban China, Gustafsson and Li (2000), Liu et al. (2000), Ma (2007, 2009a), Li and Yang (2010), Li et al. (2011), and Ma et al. (2013) used the Blinder-Oaxaca decomposition model (Blinder 1973; Oaxaca 1973), the Oaxaca-Ransom decomposition model (Oaxaca and Ransom 1994), or the Melly decomposition model (Melly 2006) to employ the decomposition analysis. They pointed out that both the explained component caused by the differences of human capital and the unexplained component caused by the discrimination

affect the gender wage gap. In most of the studies, a comparison of the influences between these two parts shows that the influence of the unexplained component is greater than that for the explained component. Thus, it is indicated that discrimination against female workers is the main reason for the gender wage gap in China. The contribution rate of influence of unexplained component for the local urban *hukou* resident group was 52.49% in 1988, 63.20% in 1995 (Gustafsson and Li 2000); 44.2–49.3% in 1995, 51.0–58.0% in 2002 (Ma 2009a); 52.0% in 1995, 69.0% in 2002, and 77.7% in 2007 (Li et al. 2011). The value for rural-urban migrants was 74.32–84.38% in 2008 (Li and Yang 2010); the value for the all urban residents and migrants in urban China was 49.18% in 1996 (Meng and Zhang 2001). In addition, the values are 86.08–101.80% in 2006, and 45.31–91.73% in 2009 by wage percentiles (Ma et al. 2013).

Many empirical studies on the effect of segmentation by sector on gender wage gaps in urban China—Wang (2005a), Li and Ma (2006), Ma (2007), Yao and Huang (2008)—analyzed the influence of occupational segregation on the gender wage gap. Wang (2005b), Ge (2007), and Wang and Cai (2008) analyzed the influences of segmentation by industry sectors. All of these studies used the Brown et al. model (Brown et al. 1980). These studies indicate that the unexplained componentt in the intra-sector differentials is the main reason for the gender wage gap.

Studies of labor market segmentation by various ownership sectors on the gender wage gap are inconclusive. Even though Liu et al. (2000), Maurer-Fazio and Hughes (2002), Demurger et al. (2007), and Guo and Zhang (2010) used the Blinder-Oaxaca model to decompose the factors affecting the gender wage gap in the public sector and the private sector separately, these studies use survey data from before 2007; information regarding the issue is scarce in the current situation. Ma (2018a) investigated the influence of ownership sector on the gender wage gap from 2002 to 2013 using Brown et al. decomposition model, but the gender wage gap in each ownership sector was not analyzed.

Using CHIPs 2002 and CHIPs 2013 for urban residents, this study investigated determinants of the gender wage gap in each ownership sector, and we will compare the results of different sectors (government organization, SOE, COEs, POEs, and self-employed sector) and by these two periods (2002 and 2013). We can discover new evidence leading to an investigation of the labor market segmentation by ownership sectors and the gender wage gap during the 2000s in urban China.

4.4 Methodology and Data

4.4.1 Model

To estimate when other factors, for example, human capital, are consistent, how segmentation by ownership sectors affects male and female wage levels and the wage functions are calculated, the OLS model is expressed as Eq. (4.1.1).[7]

$$lnW_i = \beta_O OWN_i + \beta_X X_i + u_i \tag{4.1.1}$$

To consider the sample selection bias problem (a worker can choose to work or not) found in the OLS model, the Heckman two-step model (Heckman 1979) is used. The estimated results of the distribution function and the density function by the probit regression model (the dependent variable is $\Pr(Y_i = 1)$, which indicates the probability of participation in work), and the inverse Mill's ratio—the adjusted items ($\lambda = \phi(.)/\Phi(.)$) are calculated. The corrected wage functions expressed by Eqs. (4.1.2) and (4.1.3) are estimated using these adjusted items.

$$lnW_i = \beta_M Male_i + \beta_O OWN_i + \beta_X X_i + \beta_\lambda \lambda_i + u_i \tag{4.1.2}$$

$$lnW_{ij} = \beta_O OWN_{ij} + \beta_X X_{ij} + \beta_\lambda \lambda_{ij} + u_{ij} \tag{4.1.3}$$

$$(j : male, female)$$

In Eqs. (4.1.1), (4.1.2), and (4.1.3), i represents the individual, j represents the male or female worker, lnW is the logarithm of wage, X represents factors (years of schooling, years of experience, industry, occupation dummy variables) which affect wage, OWN is the ownership sector dummy variable, and u is a random error item. The results of Eq. (4.1.2) indicate the overall influences of sector segmentation by ownership on wages for the total sample; the results of Eq. (4.1.3) show the influences of ownership types on wages for males and females separately.

Next, to decompose the determinants of the gender wage gap, the Blinder-Oaxaca decomposition model[3] (Blinder 1973; Oaxaca 1973) is used. The decomposition model is expressed as Eq. (4.2.1) and Eq. (4.2.2).[4]

$$lnW_m - lnW_f = \beta_{\mathrm{m}}\left(X_m - X_f\right) + (\beta_{\mathrm{m}} - \beta_f)X_f \tag{4.2.1}$$

$$lnW_m - lnW_f = \beta_{\mathrm{f}}\left(X_f - X_m\right) + (\beta_{\mathrm{f}} - \beta_{\mathrm{m}})X_m \tag{4.2.2}$$

In Eq. (4.2.1) and Eq. (4.2.2), X_m and X_f are variable means of men and women, respectively. β_{m} and β_{f} are estimated coefficients in wage functions. Based on the human capital theory (Becker 1964; Mincer 1974) and discrimination hypothesis (Becker 1957; Arrow 1972, 1973; Phelps 1972), the decomposition model decomposes the wage gap between men and women into two parts: the human capital endowment (known as the explained component) $[\beta_{\mathrm{m}}\left(X_m - X_f\right)$ or$\beta_{\mathrm{f}}(X_f - X_m)]$ and the endowment return (known as the unexplained component) $([(\beta_{\mathrm{m}} - \beta_{\mathrm{f}})X_f$ or $(\beta_{\mathrm{f}} - \beta_{\mathrm{m}})X_m]$. The explained component expresses the differentials of individual characteristics such as the differences in human capital endowments. The unexplained component includes the differences in return to human capital, wage determination systems, discrimination, or capabilities not presently measurable. The larger

the estimated explained component is, the greater is the influence of human capital differences between men and women on the wage gap, and vice versa.

4.4.2 Data and Variable Setting

The survey data of CHIPs 2002 and CHIPs 2013 are used for the analysis. The data was compiled by the Economic Institute of the Chinese Academy of Social Sciences (CASS) and Beijing Normal University in 2003 and 2014. The sampling method is stratified random sampling based on samples of the National Bureau of Statistics (NBS). Because there are design similarities in the questionnaire data, we can use the same information for analyzing the two periods. CHIPs covers the representative regions in China, including Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Guangdong, Henan, Hubei, Sichuan, Chongqi, Yunnan, and Gansu in 2002; and Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Guangdong, Henan, Hubei, Sichuan, Chongqi, Yunnan, Gansu, Shandong, and Hunan in 2013. For comparing the two periods, we selected the regions (provinces) covered in two surveys, including Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Guangdong, Henan, Hubei, Sichuan, Chongqi, Yunnan, and Gansu.

The analytic objects of this study are workers of local urban residents. Because the sample selection bias for the choice of work or non-work is considered in the study, working and non-working individual samples are used. In considering the mandatory retirement system[5] implemented in the public sector, the analytic objects are limited to groups aged 16–59. All of the abnormal value samples[6] and the missing value samples were deleted. The samples used in analysis including working and non-working individuals is 14,607 for 2012, 13,549 for 2013.

To maintain the analysis samples by each ownership sector and to consider the features of the sectors' distributions, based on CHIPs 2002 and CHIPs 2013 questionnaires, work sectors are divided into seven categories: (i) the group in the public organizations, including government organization and the relationship of work units with the government, called "*Shiye Danwei*" (GOVs); (ii) the group in state-owned enterprises (SOEs); (iii) the group in collectively owned enterprises (COEs); (iv) the group in the privately owned enterprises (POEs), including the group in domestic privately owned enterprises and foreign-owned enterprises (FOEs)[7]; (v) the group in the self-employed sector (Self); (vi) the group in other ownerships sector that is not included in (i)–(v) (Others); and (vii) the non-working group.

In the wage function, the dependent variable is the logarithm value of hourly wage. The *wage* is defined as "the total earnings from work." It comprises the basic wage, bonus, and any subsidy, which is calculated based on market prices. The hourly wage are calculated based on total wages and corresponding work hours. For example, in 2002, work hours yearly were calculated as work hours daily $\times$ work day monthly $\times$ work months yearly; hourly wage are calculated by total yearly wages divided by yearly work hours. The consumer price index (CPI) in 2002 is used as the standard for adjusting the nominal wage every year.

Independent variables are those likely to affect the wage level and the probability of entry to sectors: they are conducted as follows.

First, the six kinds of ownership sector dummy variables are: the government organizations (GOVs), the state-owned enterprises (SOEs), the collectively owned enterprises (COEs), the privately owned enterprises (POEs), self-employed (Self), and other ownerships sectors (Other).

Second, age, years of schooling, years of experience, [8] and health status (if the answer is "very good" or "good," it is equal to 1; otherwise it is equal to 0) are used as the indices of human capital. It is thought that these factors may affect wages or the probability of entry to various ownership sectors.

Third, considering marital status (having spouse is equal to 1, otherwise 0) and ethnicity (Han ethnicity is equal to 1, minority ethnicity is equal to 0) might affect the probability of entry to the sector or wage levels, these dummy variables are used.

Fourth, because wage gaps occur by occupation and industry sectors, occupation dummy variables (manager, professional worker and technician, production worker, clerical staff, others) and industry sector dummy variables are used. To maintain the analysis samples by each industry category, the industrial categories[9] are reclassified. Five kinds of industries—construction and manufacturing, retail, wholesale, service, and other industries—are used to construct the category variables.

Fifth, because the regional disparity for economic development levels and the labor markets differ by region, East, Central, and West region dummy variables are used to control these influences.

4.5 Descriptive Statistical Results

4.5.1 Gender Gap of Individual Characteristics

The mean values of variables by male and female group and the gender gap are shown in Table 4.1.

First, the gender wage gap (the gender gap of the logarithmic value of hourly wage) increased from 0.179 (2002) to 0.270 (2013). It is observed that as market-oriented reforms progressed in China, the gender wage gap has expanded.

Second, the gender gaps of age, years of experience, years of schooling, and health status are small in both 2002 and 2013. This suggests that the gender gap of human capital is small.

Third, the distribution proportion of occupation types differs by gender. For example, the proportions of managers are 10.5% (2002) and 1.8% (2013) higher for males than for females.

Fourth, the distribution proportion of ownership sectors differs by gender. For example, the percentages of workers in SOEs are 7.4% (2002) and 6.3% (2013) higher for males than for females, while the percentages of workers in COEs and POEs are higher for females than for males. This indicates that the distribution

Table 4.1 Gender gap of individual attributes

	2002			2013		
	Male	Female	Gap	Male	Female	Gap
Log. hourly wage	1.628	1.449	0.179	2.430	2.160	0.27
Age	41	39	2	42	40	2
Exp	30	27	3	24	22	2
Years of schooling	12	11	1	12	12	0
Health	70.2%	66.0%	4.2%	82.0%	81.8%	0.2%
Han race	95.9%	95.7%	0.2%	95.3%	95.0%	0.3%
Married	89.2%	86.7%	2.5%	86.8%	86.3%	0.5%
Occupation category						
Manager	19.5%	9.0%	10.5%	6.2%	4.4%	1.8%
Prof. and Tech	18.0%	23.9%	−5.9%	15.3%	16.1%	−0.8%
Prod. Worker	20.6%	23.5%	−2.9%	8.1%	8.3%	−0.2%
Clerical staff	33.0%	23.8%	9.2%	24.4%	12.8%	11.6%
Other	8.8%	19.8%	−11.0%	45.9%	58.3%	−12.4%
Ownership sector						
GOVs	31.5%	33.1%	−1.6%	24.1%	24.1%	0.0%
SOEs	38.6%	31.2%	7.4%	19.4%	13.1%	6.3%
COEs	5.4%	9.2%	−3.8%	4.5%	4.8%	−0.3%
POEs	14.4%	14.8%	−0.4%	26.6%	28.7%	−2.1%
Self	8.3%	8.3%	0.0%	18.2%	20.2%	−2.0%
Other	1.7%	3.5%	−1.8%	7.3%	9.2%	−1.9%
Industry sector						
Cons. & manu	31.1%	26.3%	4.8%	22.8%	14.9%	7.9%
Retail	9.5%	14.6%	−5.1%	12.8%	23.7%	−10.9%
Service	8.8%	14.9%	−6.1%	16.4%	20.9%	−4.5%
Other	50.5%	44.2%	6.3%	48.0%	40.5%	7.5%
Region category						
East	38.8%	39.0%	−0.2%	41.3%	42.2%	−0.9%
Central	35.4%	33.9%	1.5%	36.7%	34.0%	2.7%
West	25.8%	27.2%	−1.4%	22.0%	23.8%	−1.8%
Observations	5,249	4,147		5,272	4,197	

Source Calculated based on CHIPs2002 and CHIPs2013
Note (1) Samples limited on age16–59
(2) gender gap = Male–Female

proportion of males is higher in the public sector, while the distribution proportion of females is higher in the private sector.

Fifth, the distribution proportion of industrial sectors differs by gender. Concretely, the percentages of workers in the construction and manufacturing industry are 4.8% (2002) and 7.9% (2013) higher for males than for females, while the percenategs of workers in retail industry are 5.1% (2002) and 10.9% (2013) higher for females than for males.

Sixth, the difference in the distribution proportion of regions by gender is small.

To sum up, it is observed that although the gender gaps of human capital and regional distributions are small, large gender differences remain in the distribution proportions of ownership sectors and occupational and industrial sectors. These factors may influence the gender wage gap, and we should consider them in the following econometric analyses.

4.5.2 Gender Wage Gap by Ownership Sector

The mean values of wage by gender in each ownership sector are shown in Table 4.2. The ratio of women to men is used as the index of gender wage gap. The higher ratio means the lower gender wage gap. The main findings are as follows.

First, in all sectors combined, wages are lower for females than for males in both 2002 and 2013. Concretely, the gender gap in monthly wages (the ratio of female monthly wages to male monthly wages) was 73.1–85.9% in 2002 and 70.6–84.7% in 2013; the hourly wage gender gap (the ratio of female hourly wages to male hourly wages) was 79.5–104.0% in 2002 and 75.0–86.7% in 2013.

Second, the gender wage gap was larger in the private sector (COEs, POEs, self-employed sector) than in the public sector (government organization and SOEs) in both 2002 and 2013. For example, in 2013, the results based on hourly wage showed that the gender wage gaps in the public sector were 86.4% (public organization) and 86.4% (SOEs); whereas, the gender wage gaps in the private sector were 78.9% (COEs) and 75.0% (POEs), and 77.8% for the self-employed sector.

Third, although the gender wage gap increased from 2002 to 2013 in all sectors, the increase in the gender wage gap was larger for the private sector than for the public sector. For example, the hourly wage gender gap increased from 91.0% (2002) to 86.4% (2013) for government organizations, and it increased from 85.2% (2002) to 75.0% (2013) for the POEs and FOEs, separately.

These tabulated calculation results indicate that the gender wage gap differs by different ownership sectors, and these calculated values changed from 2002 to 2013.

Table 4.2 Gender wage gaps in each ownership sector

	2002			2013		
	Male	Female	Gender gaps (%)	Male	Female	Gender gaps (%)
Monthly wage (Yuan)						
GOVs	1,314	1,129	85.9	3,838	3,156	82.2
SOEs	1,077	887	82.4	3,900	3,305	84.7
COEs	786	643	81.8	3,273	2,312	70.6
POEs	1,112	884	79.5	3,695	2,681	72.6
Self	874	639	73.1	3,635	2,570	70.7
Others	866	718	82.9	2,529	1,801	71.2
Total	1,051	796	75.7	3,651	2,751	75.3
Hourly wage (Yuan)						
Pub	7.8	7.1	91.0	22.0	18.6	86.4
SOEs	6.3	5.4	85.7	21.9	19.0	86.4
COEs	4.3	3.9	90.7	18.5	15.4	78.9
POEs	6.1	5.2	85.2	19.9	15.0	75.0
Self	3.9	3.1	79.5	17.6	13.5	77.8
Others	5.0	5.2	104.0	15.0	13.1	86.7
Total	6.4	5.5	85.9	20.0	15.9	80.0

Source Calculated based on CHIPs2002 and CHIPs2013

Note (1) Gender gap of monthly wage = Females /Males; Gender gap of hourly wage = Females /Males

(2) Pub: government organizations; SOEs: state-owned enterprises; SOEs: collectively owned enterprises; POEs: privately owned enterprises including domestic privately owned enterprises and foreign owned enterprises; Self: self-employment sector; Other: the other sector

4.6 Econometric Analysis Results

4.6.1 How Does the Ownership Sector Affect Wage Levels?

When other factors including ownership sectors are held constant, does the gender wage gap occur? How does the ownership sector affect wage levels? Does the gender wage gap differ by ownership sector? To answer these questions, wage functions are estimated by using the total sample and subsamples distinguished by ownership types. The results are shown in Table 4.3 (total sample) and Table 4.4 (subsample). The Heckman two-step model is used to adjust the sample selection bias caused by the choice of work or non-work.

First, when other factors are constant, the logarithm values of hourly wages for males are 5.9% (2002) and 18.5% (2013) points higher than for females (see Table 4.3). This indicates that, except for the individual characteristic differentials that are controlled in the model, other factors (discrimination against females, unobservable

Table 4.3 Results of wage function

	2002		2013	
	coef	t-value	coef	t-value
Male	0.050***	3.67	0.186***	9.76
Ownership (GOVs)				
SOEs	−0.082***	−4.65	0.086***	3.41
COEs	−0.385***	−13.76	−0.051	−1.33
POEs	−0.094***	−4.11	0.011	0.44
Self	−0.564***	−19.81	−0.012	−0.43
Others	−0.324***	−7.79	−0.143***	−4.47
Years of schooling	0.053***	16.42	0.077***	23.23
Years of Experience	0.020***	3.33	0.017***	3.77
Years of Experience squared	−0.000	−0.9	−0.000*	−1.79
Health	−0.019	−1.39	0.079***	4.00
Han race	−0.026	−0.84	0.035	1.03
Occupation (Clerical staff)				
Manager	0.095***	4.33	0.188***	5.19
Prof. and Tech	0.132***	6.99	0.122***	3.84
Prod. Worker	−0.085***	−4.38	−0.090***	−3.17
Others	−0.184***	−7.65	−0.098***	−4.36
Industries (Cons. & Manu.)				
Retail/Catering	−0.063**	−2.52	−0.143***	−5.03
Service	−0.026	−1.06	−0.122***	−4.57
Others	0.163***	9.23	0.027	1.14
Region (East)				
Central	−0.407	−26.99	−0.201***	−11.75
West	−0.324	−20.56	−0.155***	−8.04
Inverse Mill's ratio	−0.146	−3.59	−0.141***	−2.98
Constant	0.817	6.79	1.165***	11.42
Observations	14,607		13,549	
Censored observations	5,211		4,080	
Uncensored observations	9,396		9,469	
Wald chi2(19)	3928.230		1850.200	
Prob > chi2	0.000		0.000	

Source Calculated based on CHIPs2002 and CHIPs2013

Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Calculated by Heckman two-step model. The Results by the selection function are not expressed in this table

Table 4.4 Estimated gender wage gaps by ownership sector

	2002		2013	
	coef	t-value	coef	t-value
GOVs	0.051***	2.59	0.145***	5.59
SOEs	0.110***	5.05	0.188***	5.20
COEs	0.044	0.85	0.294***	4.18
POEs	0.091**	2.55	0.214***	7.58
Self	0.196***	3.53	0.304***	7.64
Others	0.238**	2.19	0.219***	3.81

Source Calculated based on CHIPs2002 and CHIPs2013
Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Samples by different ownership sectors are used in these estimations
(3) Calculated by Heckman two-step model. Years of schooling, years of experience, years of experience squared, health, ethnicity, occupation, industry, region dummy variables are calculated, the results are not showed in this table
(4) The Results of the selection function are not expressed in this table

individual ability) affect the gender wage gap in both 2002 and 2013. Moreover, the results show that the gender wage gap expanded from 2002 to 2013.

Second, as compared with workers in government organizations, wage levels are lower for workers in other sectors (see Table 4.3). In 2002, average wage levels were 8.2% points lower for workers in SOEs, 38.5% points lower for workers in COEs, 9.4% points lower for workers in the POEs, 56.4% points lower for workers in the self-employed sector, and 32.4% points lower for workers in other sectors. In 2013, average wage levels were 8.6% points higher for workers in SOEs and 14.3% points lower for workers in other sectors. However, when other factors are held constant, the wage gap between public organizations and COEs, POEs, and the self-employed sector is not statistically significant. This might be due to the increased influence of other factors (individual characteristics, including human capital) on wages from 2002 to 2013 in the private sector.

Third, the gender wage gap differs among ownership sectors, and the wage gap changed from 2002 to 2013 in all sectors (see Table 4.4). When the coefficient is a positive value and it is statistically significant at the 1% or 5% statistical level, it denotes that there maintains a gender wage gap. The coefficient of the male dummy variable in wage function is utilized as an index of the gender wage gap. It is observed that in 2002, the gender wage gap in SOEs (11.0% points), POEs (9.1% points), the self-employed sector (19.6% points), and other sectors (23.8% points) was higher than that in government organizations (5.1% points). In 2013, the gender wage gap in SOEs (18.8% points), COEs (29.4% points), the POEs (21.4% points), the self-employed sector (30.4% points), and other sectors (21.9% points) was higher than that in government organizations (14.5% points). These results show that the gender wage gap was higher in the private sector than that in the public sector in both 2002 and 2013, and the disparity in the gender wage gaps of the public and private sectors increased from 2002 to 2013.

4.6.2 How Does the Ownership Sector Affect the Gender Wage Gap?

Which factors contribute to gender wage gap? How does the ownership sector affect the gender wage gap? To answer these questions, we employed a decomposition analysis based on the Blinder-Oaxaca decomposition model using the total samples including five kinds of ownership sectors. The results are summarized in Table 4.5. The new findings are as follows.

First, in general, although both the explained component and the unexplained component contribute to the gender wage gap in 2002 and 2013, the contribution rate of the unexplained component on the gender wage gap increased from 51.9% (2002) to 80.2% (2013). This indicates that as market-oriented economy reform progresses,

Table 4.5 Decomposition results of gender wage gap

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained (%)
【2002】				
Total	0.086	0.093	48.1	51.9
Ownership	0.015	0.011	8.5	6.0
Education	0.008	−0.128	4.7	−71.8
Experience	0.029	0.002	16.2	1.0
Health	0.000	0.010	0.0	5.6
Ethnic	0.000	0.067	0.0	37.5
Occupation	0.023	0.039	12.9	21.6
Industry	0.012	0.021	6.7	11.8
Region	−0.002	−0.004	−0.9	−2.4
Constants	0.000	0.076	0.0	42.6
【2013】				
Total	0.053	0.216	19.8	80.2
Ownership	0.006	0.067	2.2	24.8
Education	0.001	0.062	0.3	22.9
Experience	0.019	0.21	7.2	77.8
Health	0.000	−0.016	0.1	−5.9
Ethnic	0.000	0.015	0.1	5.5
Occupation	0.009	0.001	3.2	0.3
Industry	0.020	0.033	7.5	12.1
Region	−0.002	0.000	−0.7	−0.2
Constants	0.000	−0.154	0.0	−57.1

Source Calculated based on CHIPs2002 and CHIPs2013
Note Decomposition based on the Blinder-Oaxaca decomposition model

the problem of discrimination against women became severe, particularly in the current period.

Second, in general, for the influence of ownership on the gender wage gap, (1) both the gender gap of the proportion of ownership sectors and discrimination against females in the same ownership sector contributed to expanding the gender wage gap in both 2002 and 2013. (2) The contribution rate of the discrimination against female workers in the same ownership sector on the gender wage gap increased from 6.0% (2002) to 24.8% (2013).

Third, the main factors contributing to the gender wage gap differ in these two periods. Concretely, in 2002, the main factors are years of experience (16.2%) and occupation (12.9%) in the explained component, and ethnicity (37.5%) and occupation (21.6%) in the unexplained component in 2013, the main factors are the industry (7.5%) and years of experience (7.2%) in the explained component, and years of experience (77.8%) and education (22.9%) in the unexplained component.

4.6.3 Does the Impact of Factors on the Gender Wage Gap Differ by Ownership Sector?

Does the impact of factors on the gender wage gap differ by ownership sector? To answer this question, we employed decomposition analysis based on the Blinder-Oaxaca decomposition model for each ownership sector. These results are summarized in Table 4.6 (government organizations), Table 4.7 (SOEs), Table 4.8 (COEs), Table 4.9 (POEs), and Table 4.10 (self-employed sector). The main results are as follows.

First, in general, in looking at the contributions of the explained component and the unexplained component, it can be seen that the contributions of the unexplained component increased from 2002 to 2013 in each ownership sector. For example, the contribution rates of the unexplained component increased from 40.1 to 68.9% in government organizations, from 64.1 to105.7% in SOEs, from 48.4 to109.3% in COEs, from 47.0 to 91.5% in POEs, and from 66.4 to 77.0% in self-employed sector. This indicates that as market-oriented economy reform progressed, the discrimination against female workers increased, and it has become the main factor contributing to the gender wage gap in the 2000s.

Second, in comparing the values of the unexplained component between the public and private sectors in the current period (2013), it can be seen that the contribution rate is greater for the public sector (105.7% for SOEs, 109.3% for COEs) than for the private sector (91.5% for POEs, 77.0% for the self-employed sector), and it is lowest for government organizations (68.9%). This indicates that, in the current period, the discrimination against female workers is greater in the public sector than in the private sector.

The public sector results can be explained by the discrimination hypothesis (Becker 1957). Concretely, it may be due to the fact that, as ownership reform

Table 4.6 Decomposition results of gender wage gap in government organizations

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained
【2002】				
Total	0.081	0.057	59.9	40.1
Education	0.022	−0.194	16.5	−142.6
Experience	0.035	−0.167	25.7	−122.9
Health	0.000	0.009	0.0	6.5
Ethnic	0.000	0.049	0.0	36.1
Occupation	0.026	0.005	18.8	3.3
Industry	0.000	0.096	0.0	70.5
Region	−0.002	0.028	−1.1	20.7
Constants	0.000	0.232	0.0	168.4
【2013】				
Total	0.063	0.140	31.1	68.9
Education	−0.017	0.074	−8.2	36.2
Experience	0.07	0.177	34.6	87.2
Health	0.000	−0.063	0.1	−30.8
Ethnic	0.000	0.039	−0.2	19.3
Occupation	0.008	0.008	4.1	4.0
Industry	0.005	−0.030	2.5	−14.8
Region	−0.004	−0.053	−1.8	−26.3
Constants	0.000	−0.012	0.0	−5.9

Source Calculated based on CHIPs2002 and CHIPs2013
Note Decomposition based on the Blinder-Oaxaca decomposition model

progressed in the SOEs, they obtained more authority to decide the wage levels of their employees; therefore, although wage and employment gender equality policies were enforced in the planned economy period, as the influences of these policies controlled by the government decreased, the problem of discrimination against female workers became severe. On the contrary, the results for the private sector can be explained by the human capital theory (Becker 1964; Mincer 1974). For firms in the private sector, the influence of market mechanisms is greater. To maximize profits in the competitive market, firms in the private sector may be likely to determine wage levels based on individual workers' productivity (human capital). Therefore, discrimination against female workers is smaller in the private sector than in the public sector.

Third, the influences of factors on the gender wage gap differ by ownership sectors. For example, in 2013, (1) for government organizations, the gender gaps of years of experience in the explained component (34.6%) and the unexplained component

Table 4.7 Decomposition results of gender wage gap in state-owned enterprises (SOEs)

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained (%)
【2002】				
Total	0.061	0.111	35.9	64.1
Education	−0.004	−0.131	−2.1	−75.3
Experience	0.018	−0.006	10.5	−3.3
Health	−0.001	0.028	−0.6	16.0
Ethnic	0.000	0.082	0.1	47.2
Occupation	0.032	0.000	18.7	−0.3
Industry	0.010	0.021	5.6	12.0
Region	0.006	0.024	3.7	13.7
Constants	0.000	0.094	0.0	54.1
【2013】				
Total	−0.010	0.188	−5.7	105.7
Education	−0.023	−0.282	−12.8	−158.3
Experience	0.015	0.027	8.6	15.1
Health	−0.003	0.169	−1.5	95.1
Ethnic	0.000	0.566	−0.3	317.6
Occupation	−0.014	0.065	−8.1	36.2
Industry	0.018	−0.005	10.2	−2.6
Region	−0.003	0.072	−1.8	40.2
Constants	0.000	−0.423	0.0	−237.7

Source Calculated based on CHIPs2002 and CHIPs2013
Note Decomposition based on the Blinder-Oaxaca decomposition model

(87.2%) are the main factors. This is because the seniority wage system is implemented in most government organizations. In government organizations, the average length of years of experience is longer for males than for females, and the longer years of work experience are evaluated to be at a higher level for males than for females; thus, the influence of years of experience is greater. (2) For SOEs, the gender differences of proportions of industry sectors (10.2%) in the explained component and ethnicity (317.6%) and health status (95.1%) in the unexplained component are the main factors. This indicates that the wage gap between a monopoly industry sector and a competitive industry sector may greatly affect the gender wage gap for workers in state-owned enterprises. (3) For COEs, the gender gap of the proportions of occupations (2.0%) in the explained component and the proportion of industry sectors (49.6%) in the unexplained component are the main factors contributing to the gender wage gap. (4) For POEs, the gender gap in the proportions of industry sectors (6.6%) in the explained component and the years of experience (83.4%) in the unexplained component are the main factors contributing to the wage gap. (5) For the

Table 4.8 Decomposition results of gender wage gap in collectively owned enterprises (COEs)

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained (%)
【2002】				
Total	0.055	0.052	51.6	48.4
Education	0.004	−0.193	4.1	−179.8
Experience	0.014	0.485	12.6	451.4
Health	−0.001	0.064	−1.3	59.1
Ethnic	0.004	0.311	3.8	289.3
Occupation	0.035	−0.053	32.7	−49.7
Industry	0.002	0.008	2.3	7.5
Region	−0.003	−0.088	−2.6	−82.2
Constants	0.000	−0.480	0.0	−447.3
【2013】				
Total	−0.025	0.294	−9.3	109.3
Education	−0.011	−0.046	−4.0	−17.1
Experience	−0.017	−0.178	−6.2	−66.3
Health	0.000	0.047	0.1	17.6
Ethnic	0.000	−0.166	−0.1	−61.9
Occupation	0.005	−0.204	2.0	−75.8
Industry	−0.004	0.133	−1.6	49.6
Region	0.001	−0.075	0.5	−28.0
Constants	0.000	0.782	0.0	291.1

Source Calculated based on CHIPs2002 and CHIPs2013
Note Decomposition based on the Blinder-Oaxaca decomposition model

self-employed sector, the gender gap of the proportions of industry sectors (12.4%) in the explained component and occupation (167.8%) as well as education (95.3%) in the unexplained component are the main factors. This indicates that discrimination against female workers even exists within a group with the same educational attainment level and the same occupation, and the influence of these discriminations is greater for the self-employed sector than for other ownership sectors.

4.7 Conclusions

Using data of the Chinese Household Income Project surveys (CHIPs) conducted in 2003 and 2014 (CHIPs 2002 and CHIPs 2013), this study explores the determinants of gender wage gaps of five kinds of ownership sectors—government organizations, state-owned enterprises (SOEs), collectively owned enterprises (COEs), privately

Table 4.9 Decomposition results of gender wage gap in privately owned enterprises (POEs)

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained (%)
【2002】				
Total	0.093	0.083	53.0	47.0
Education	−0.005	0.018	−2.7	10.4
Experience	0.069	0.123	39.2	70.1
Health	−0.001	−0.028	−0.3	−15.9
Ethnic	0.000	0.036	−0.1	20.7
Occupation	0.024	0.199	13.4	113.1
Industry	0.004	0.028	2.0	15.9
Region	0.003	−0.009	1.6	−5.0
Constants	0.000	−0.286	0.0	−162.2
【2013】				
Total	0.020	0.217	8.5	91.5
Education	−0.004	0.014	−1.8	5.9
Experience	0.014	0.198	6.1	83.4
Health	−0.003	−0.132	−1.1	−55.5
Ethnic	0.000	0.113	0.2	47.5
Occupation	−0.004	−0.089	−1.7	−37.5
Industry	0.016	0.003	6.6	1.3
Region	0.001	0.021	0.2	8.7
Constants	0.000	0.090	0.0	37.7

Source Calculated based on CHIPs2002 and CHIPs2013
Note Decomposition based on the Blinder-Oaxaca decomposition model

owned enterprises (POEs), and the self-employed sector—from 2002 to 2013 in urban China. A decomposition analysis of the gender wage gap is employed. Several major conclusions emerge.

First, the gender wage gap exists. When all factors including the human capital factor and ownership dummy variables are held constant, the gender wage gap persisted in both 2002 and 2013, and the gender wage gap expanded from 2002 to 2013.

Second, both the gender differences of human capital and discrimination against female workers contribute to the gender wage gap; the influence of the unexplained part (e.g., discrimination against female workers) increased in each ownership sector from 2002 to 2013. The range of increase of the influence of the unexplained part is greater for firms in the public sector than for those in the private sector.

Third, the influence (contribution rate) of factors on the gender wage gap differs by ownership sectors. Concretely, (1) years of work experience in the explained component and work experience years in the unexplained component are the main

Table 4.10 Decomposition results of gender wage gap in self-employed sector

	Values		Percentage	
	Explained	Unexplained	Explained (%)	Unexplained (%)
【2002】				
Total	0.098	0.194	33.6	66.4
Education	0.009	0.031	3.2	10.8
Experience	0.005	−0.365	1.8	−124.9
Health	0.004	0.001	1.3	0.2
Ethnic	−0.001	0.070	−0.4	24.0
Occupation	0.011	0.663	3.8	227.0
Industry	0.056	−0.251	19.3	−86.1
Region	0.013	−0.067	4.6	−22.9
Constants	0.000	0.112	0.0	38.4
【2013】				
Total	0.086	0.288	23.0	77.0
Education	0.013	0.357	3.4	95.3
Experience	0.006	0.309	1.6	82.5
Health	0.004	0.003	1.1	0.7
Ethnic	0.000	−0.112	0.0	−30.0
Occupation	0.011	0.629	3.0	167.8
Industry	0.046	0.197	12.4	52.7
Region	0.006	−0.014	1.5	−3.8
Constants	0.000	−1.080	0.0	−288.2

Source Calculated based on CHIPs2002 and CHIPs2013.
Note Decomposition based on the Blinder-Oaxaca decomposition model

factors for government organizations; (2) industry sector in the explained component and ethnicity and health status in the unexplained component are the main factors for SOEs; (3) occupation in the explained component and industry in the unexplained component are the main factors for COEs; (4) industry in the explained component and the years of experience in the unexplained component are the main factors for POEs; (5) industry sector in the explained component and the occupation as well as education in the unexplained component are the main factors for the self-employed sector.

These findings indicate that as market-oriented economy reforms progress, the problem of discrimination against female worker is becoming severe, particularly for SOEs and COEs in the public sector. In order to reduce the gender wage gap, employment equality laws and an equal pay for equal work policy should be implemented and enforced by the Chinese government.

Notes

1. Based on the classification that is utilized in most of the previous studies, in this study, the period from 1949 to 1977 is called "the planned economy period," in which the Chinese government tried to establish a management economy system based on the Soviet Union's socialist nation management model, and the period after 1978 is called "the market-oriented reform period.".
2. Based on data of the third CFSSS, the female labor participation rate decreased from 87.1% in 1990 to 60.8% in 2010.
3. Although Reimers (1983), Cotton (1988), Neumark (1988), Oaxaca and Ransom (1994), and Fortin (2008) argued that there is an "index number" problem in the basic Blinder-Oaxaca decomposition model, the classifications of the unexplained component and the unexplained component in these studies are similar to those of Blinder (1973) and Oaxaca (1973). Two decompositions based on Eqs. (4.2.1) and (4.2.2) are employed, and these results are almost identical. Thus, only the results based on Eq. (4.2.1) are shown in this chapter.
4. In order to simplify the expression of equations following, all constant items are omitted.
5. In the public sector, the legal retirement age is 50 for female workers (blue collar workers), 55 for female cadres (white collar workers), and 60 for male workers and male cadres.
6. That variable values are not in the range of "mean value ± three times S.D." is defined as an abnormal value here.
7. In CHIPs 2002, the sample of workers in foreign-owned enterprises is relatively smaller and cannot be analyzed in the decomposition analysis; workers in privately owned enterprises or foreign-owned enterprises are combined into one group.
8. Years of experience = age-6-years of schooling.
9. The number of industry categories is 16 in CHIPs 2002, and 50 in CHIPs 2013.

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Chapter 5
Gender Gap of Communist Party of China Membership

Abstract Using data of the Chinese Household Income Project survey (CHIPs), this study investigates the determinations for becoming a CPC member, and decomposes the wage gap between CPC and non-CPC members based on the Blinder-Oaxaca decomposition model. It is found that the probability of becoming a CPC member is 7.3–7.7% points lower for female workers than for male workers; the wage premium of CPC membership is higher for female workers (around 34.7%) than for male workers (4.8–30.8%); the endowment differentials such as the difference in years of schooling, distributions of occupations, and industry sectors are the main factors affecting the wage gap for both female and male workers, and the contributions of endowment differentials are greater for female workers than for male workers.

Keywords Gender gap · Communist Party of China · Membership · Wage premium

5.1 Introduction

In China, despite the drastic transition from a planned economy to a market-oriented economy, because the government has employed a gradual reform, the de facto Communist Party of China (CPC) dictatorship is strongly maintained in the political sphere.[1] This fact creates a very unique aspect of the Chinese economy. Therefore the wage premium of CPC membership is an important issue in Chinese economy.

Neither theoretical nor empirical works can reach a certain conclusion on this issue. From a theoretical perspective, five hypotheses can explain the influence of CPC membership on wages (Ma and Iwasaki 2021). Concretely, it is thought that the ability of an individual to become a CPC member is a kind of human capital that includes organizational ability, collective control capability, job motivation, and non-cognitive social ability (the human capital theory). In addition, CPC membership works as a clear signal to distinguish CPC members from citizens by a third party (the signaling hypothesis). Furthermore, as compared with nonmembers, CPC members

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can utilize CPC organizations and connections with other members to effectively obtain economic benefits (Bian et al. 2015; McLaughlin 2017; Ma 2019). In other words, party membership can be regarded as a sort of political and social capital in China (the political and social capital hypothesis). Based on these three hypotheses, it is expected that CPC membership positively affects the wage level of CPC members. In contrast, with the progress of the market-oriented economy reform and the separation of the political and economic systems, the unique abilities of CPC members, represented by their belief in Marxist ideology and organizational loyalty to the party, may become a harmful factor for firm management based on market mechanisms (the marketization hypothesis). In addition, when the corruption of the CPC organization and party members is revealed, it may increase social criticism or popular psychological antipathy toward them (the negative rumor hypothesis). Because the above-mentioned hypotheses contradict each other, we cannot theoretically predict the direction of the impact of CPC membership on wage levels in China based on the above-mentioned hypotheses. Thus, empirical studies should be employed to investigate the impact of CPC membership on wages.

The results of empirical analysis are also inconclusive.[2] In fact, there is a series of studies (Gustafsson and Li 2000; Knight and Song 2003; Appleton et al. 2005, 2009; Bishop et al. 2005; Li et al. 2007, 2012; Xing 2014; McLaughlin 2017; Ma 2018a, b; MacDonald and Hasmath 2018; Wang and Lien 2018; Nikolov et al. 2019) that found a positive association between CPC membership and wage levels, whereas a set of studies, such as those of Li and Zhang (2003) and Wang and Lien (2018), reported that the effect of CPC membership on wages is not statistically significant. Moreover, more than a few studies supporting the marketization hypothesis and the negative rumor hypothesis, such as Xing (2014) and Ma (2018a) found that CPC membership negatively affects wage levels.

Although some empirical studies have estimated the influence of CPC membership on wages, a set of important issues remains to be discussed as follows. First, empirical studies on the determinants of becoming a CPC member are scarce. Second, most previous studies did not address the sample selection bias problem in the wage function, which is usually caused by the fact that the probability of becoming a CPC member is not a random distribution.[3] Third, although it is predicted that the wage gap between CPC members and nonmembers may be caused by human capital differentials (eg., educational attainment)[4] between these two groups or the wage determinate system, including discrimination against nonmembers, no empirical study has focused on the issue. In China, with the progress of market-oriented economy reform, the problem of income inequality is worsening; therefore, a study on the wage gap between CPC members and nonmembers can provide new evidence. Fourth, although it can be assumed that the determinants of participation in the CPC and the wage gap between CPC members and nonmembers may differ by gender, there has been no empirical study of this issue.

The main contributions of this study are as follows. First, we investigate the determinants of becoming a CPC member, which has not been analyzed in previous studies. Second, to consider the sample selection bias problem, we utilize the Heckman two-step model (Heckman 1979) in the wage function. Third, based on

the Blinder-Oaxaca decomposition model (Blinder 1973; Oaxaca 1973; Oaxaca and Choe 2016), this study investigates how the explained component (human capital differentials) and unexplained component (the wage system or discrimination) affect the wage gap between CPC members and nonmembers, considering the sample selection bias problem simultaneously. Fourth, this is the first study to compare the wage premium of CPC membership and its impact on the wage gap between CPC members and nonmembers by gender.

The remainder of this chapter is organized as follows: Sect. 5.2 introduces the methodology including the decomposition model and data. Section 5.3 summarizes the results of descriptive statistics by CPC members and nonmembers. Section 5.4 introduces and explains the econometric analysis results. Section 5.5 summarizes the major findings and concludes the study.

5.2 Methodology and Data

5.2.1 Model

First, to investigate the determinants of participation in the CPC, a probit regression model is utilized as follows:

$$\Pr(Y_i = 1) = \Pr(a + \beta_H H_i + \varepsilon_i > 0) \tag{5.1}$$

In Eq. (5.1), $\Pr(Y_i = 1)$ is the dependent variable, which is the probability of participation in the CPC organizations. i represents the individual, H represents factors (e.g., individual characteristics, job, parents in the public sector) that affect the probability of participation in the CPC, β is the estimated coefficient, and ε is a random error item.

Second, to estimate the wage premium of CPC membership, the wage functions are estimated. The wage function by the ordinary least squares (OLS) model is expressed as Eqs. (5.1) and (5.2).[5]

$$lnW_i = a + \beta_{cpc} CPC_i + \beta_X X_i + u_i \tag{5.2}$$

In Eq. (5.2), lnW is the logarithmic value of the average wage, X represents factors (e.g., education, years of experience) that may affect the wage level, β is the estimated coefficient, and u is a random error item. When β_{cpc} is statistically significant and is a positive value, it indicates that when other factors (e.g., human capital) are held constant, a wage premium of CPC membership remains—the wage level is higher for CPC members than for their non-CPC counterparts.

To consider the sample selection bias problem (a worker chooses by him(her)self or is selected by the CPC to become a CPC member) left in the OLS model, the Heckman two-step model (Heckman 1979) is used. Using the estimated results of

the distribution function ($\Phi(\cdot)$) and the density function ($\phi(\cdot)$) by the probit regression model (the dependent variable is $\Pr(Y_i = 1)$, which indicates the probability of becoming a CPC member; see Eq. (5.1), the adjusted item for CPC members and nonmembers are calculated. Concretely, the adjusted item for the CPC member group is calculated as $\lambda = \phi(\cdot)/\Phi(\cdot)$. The corrected wage function expressed by Eq. (5.3) is estimated using the adjusted item.

$$lnW_i = a + \beta_{cpc} CPC_i + \beta_X X_i + \beta_\lambda \lambda_i + u_i \tag{5.3}$$

Finally, Blinder-Oaxaca decomposition model based on variable means is used to estimate the determinants of wage gap between CPC members and nonmembers. As referenced in Blinder (1973), Oaxaca (1973), and Oaxaca and Choe (2016), the Blinder-Oaxaca model is expressed by Eq. (5.4) and Eq. (5.5), and the Oaxaca and Choe model is expressed by Eqs. (5.6) and (5.7) as follows[6]:

$$lnW_{cpc} - lnW_{ncpc} = \beta_{\text{cpc}}(X_{cpc} - X_{ncpc}) + (\beta_{\text{cpc}} - \beta_{\text{ncpc}})X_{ncpc} \tag{5.4}$$

$$lnW_{cpc} - lnW_{ncpc} = \beta_{\text{ncpc}}(X_{ncpc} - X_{cpc}) + (\beta_{\text{ncpc}} - \beta_{\text{cpc}})X_{cpc} \tag{5.5}$$

$$\begin{aligned} lnW_{cpc} - lnW_{ncpc} = {} & \beta_{\text{cpc}}(X_{cpc} - X_{ncpc}) + (\beta_{\text{cpc}} - \beta_{\text{ncpc}})X_{ncpc} \\ & + \beta_{\text{cpc}}(\lambda_{cpc} - \lambda_{ncpc}) + (\beta_{\text{cpc}} - \beta_{\text{ncpc}})\lambda_{ncpc} \end{aligned} \tag{5.6}$$

$$\begin{aligned} lnW_{cpc} - lnW_{ncpc} = {} & \beta_{\text{ncpc}}(X_{ncpc} - X_{cpc}) + (\beta_{\text{ncpc}} - \beta_{\text{cpc}})X_{cpc} \\ & + \beta_{\text{ncpc}}(\lambda_{ncpc} - \lambda_{cpc}) + (\beta_{\text{ncpc}} - \beta_{\text{cpc}})\lambda_{cpc} \end{aligned} \tag{5.7}$$

X_{cpc} and X_{ncpc} are variable means of CPC members and nonmembers. β_{cpc} and β_{ncpc} are estimated coefficients. Based on the human capital theory (Becker 1964; Mincer 1974) and the discrimination hypothesis (Becker 1957), the decomposition model decomposes the wage gap between CPC members and nonmembers into two parts: for example, in the Oaxaca and Choe decomposition model, the explained component $[\beta_{\text{cpc}}(X_{cpc} - X_{ncpc}) + \beta_{\text{cpc}}(\lambda_{cpc} - \lambda_{ncpc})$ or $\beta_{\text{ncpc}}(X_{ncpc} - X_{cpc}) + (\beta_{\text{cpc}} - \beta_{\text{ncpc}})\lambda_{ncpc}]$ and the unexplained component $[(\beta_{\text{cpc}} - \beta_{\text{ncpc}})X_{ncpc} + \beta_{\text{ncpc}}(\lambda_{ncpc} - \lambda_{cpc})$ or $(\beta_{\text{ncpc}} - \beta_{\text{cpc}})X_{cpc} + (\beta_{\text{ncpc}} - \beta_{\text{cpc}})\lambda_{cpc}]$.[7]

The explained component expresses the differentials of individual characteristics, such as the differences in human capital endowments. The unexplained component includes differences in the wage determination systems, discrimination, or capabilities not presently measurable. It can be said that the larger the estimated unexplained component is, the greater is the influence of discrimination against CPC members regarding the wage gap.

5.2.2 Data and Variable Setting

Data from the Chinese Household Income Project survey (CHIPs) are used for the analysis. CHIPs 2013 was conducted in 2014 by Beijing Normal University and the National Bureau of Statistics (NBS) of China. CHIPs 2013 covers local urban residents, migrants, and rural residents. Considering that the proportion of CPC members is lower for migrants and most workers earn wages in urban areas, local urban resident samples are utilized in this study. CHIPs 2013 includes information about individual and household characteristic factors, job status, and wages. Particularly, we can obtain information about the parents' workplace (public sector or private sector), which can be utilized as an identification variable in the Heckman two-step model. The CHIPs sample is part of the samples in the NBS, which covers 15 representative provinces or metropolises, including Beijing, Shanxi, Liaoning, Jiangsu, Shandong, Anhui, Guangdong, Henan, Hubei, Hunan, Chongqing, Sichuan, Yunnan, Gansu, and Xinjiang in the eastern, central, and western regions of China.

The analytic objects are workers of urban residents, excluding the unemployed. Regarding the mandatory retirement system implemented in the public sector (e.g., SOEs and government organizations),[8] the analytic objects are limited to the samples ages 16–59. No answer samples, abnormal value samples,[9] or missing value samples are deleted. The samples used in the analysis is 10,755.

To see the dependent variables setting, first, in the probability function of participation in the CPC, the dependent variable is a binary category variable; it is equal to 1 when a worker is a CPC member. Second, in the wage function and decomposition model, the dependent variable is the logarithmic value of the hourly wage. The hourly wage is calculated based on wages and work hours. The wage includes the basic wage, bonuses, and cash subsidies.

The independent variables are those likely to affect the probability of participation in the CPC organization and the wage level: they are constructed as follows. First, for the individual characteristic factors, (1) the educational dummy variables (primary school or below, junior high school, senior high school/vocational school, college and above) and years of experience[10] are constructed as an index of human capital. It is expected that the wage level and probability of participation in the CPC are higher for the highly educated and long years of experience groups.

(2) Some previous studies have pointed out that a gender wage gap remains in the Chinese labor market.[11] The male dummy variable is constructed to investigate the gender gap. When gender gaps remain in wages and in the probability of participating in the CPC organization, the coefficients of male dummy variables in these models are statistically significant.

Second, for the job factors, (1) five kinds of occupation dummy variables (manager/technician, clerk, manufacturing worker, service worker, and others) are constructed. (2) Five kinds of industry dummy variables (construction, manufacturing, sales, service, and others) are utilized to control the industry sector disparities.[12] (3) It is pointed out that there are wage gaps between the public sector and the

private sector.[13] The public sector and private sector dummy variables are employed to control the influence of ownership types on wages. Concretely, the public sector (PUB) includes the government organizations (GOVs) and state-owned enterprises (SOEs). The private sector is composed of collectively owned enterprises (COEs), foreign-owned enterprises (FOEs), privately owned enterprises (POEs), and others. It can be expected that the probability of becoming a CPC member and the wage level may be higher for the public sector than the private sector (COEs, POEs, FOEs).

Third, to control the regional disparity, eastern, central, and western region dummy variables are constructed.

Fourth, it can be thought that when a worker's parents are working or have worked in the public sector (e.g., the government organizations, SOEs), the worker may obtain political or social capital and more information about the CPC from the parents, which may increase the probability of becoming a CPC member. Using the information in the CHIPs 2013 questionnaire about the parents' workplaces, a binary dummy variable of parents in the public sector is constructed, which is equal to 1 when a worker's parents (father or mother) are working or worked in the public sector or to 0 when they have not.

5.3 Descriptive Statistic Results

5.3.1 Differentials of Characteristics of CPC and Non-CPC

Table 5.1 summarizes the descriptive statistics by total sample, CPC members, and nonmembers. The gap of mean values between CPC members and nonmembers is calculated. It can be observed that the differentials of mean values of variables between these two groups remain. It can be observed that the mean values and the distributions in various sectors differ between these two groups. For example, the proportions of highly educated workers are 8.4% (college) and 30.3% (university) higher for CPC members than for nonmembers. It seems that the human capital level is higher for CPC members, which may affect the wage gap between these two groups.

5.3.2 Wage Gaps Between CPC and Non-CPC by Gender and Other Groups

The mean values of hourly wages of CPC members and nonmembers are summarized in Table 5.2. The wage gaps between these two groups are calculated. The main findings are as follows.

Table 5.1 Description statistics of variables

	Total		CPC		Non-CPC		Gap
	Mean	S.D	Mean	S.D	Mean	S.D	
Party	0.189	0.392					
Log.wage	2.191	0.784	2.482	0.744	2.123	0.777	0.359
Female	0.440	0.496	0.322	0.467	0.467	0.499	−0.145
Experience year	28.942	11.193	29.344	10.658	28.848	11.313	0.496
Age							
Aged 16–29	0.168	0.373	0.091	0.288	0.185	0.389	−0.094
Aged 30–39	0.278	0.448	0.273	0.445	0.279	0.449	−0.006
Aged 40–49	0.351	0.477	0.360	0.480	0.349	0.477	0.011
Aged 50–60	0.204	0.403	0.276	0.447	0.187	0.390	0.089
Education							
Primary	0.058	0.234	0.004	0.067	0.071	0.257	−0.067
Junior high school	0.289	0.453	0.092	0.289	0.335	0.472	−0.243
Senior high school	0.294	0.456	0.231	0.422	0.309	0.462	−0.078
College	0.179	0.383	0.247	0.432	0.163	0.369	0.084
University	0.180	0.384	0.425	0.494	0.122	0.328	0.303
Occupation							
Manager and engineer	0.225	0.417	0.337	0.473	0.198	0.399	0.139
Clerk	0.144	0.351	0.320	0.466	0.103	0.304	0.217
Manufacturing worker	0.200	0.400	0.104	0.305	0.223	0.416	−0.119
Service worker	0.301	0.459	0.143	0.350	0.338	0.473	−0.195
Other	0.129	0.336	0.096	0.295	0.137	0.344	−0.041
Ownership type							
PUB	0.372	0.483	0.730	0.444	0.288	0.453	0.442
COEs	0.045	0.207	0.045	0.208	0.045	0.207	0.000
FOEs	0.028	0.165	0.011	0.104	0.032	0.176	−0.021
POEs	0.256	0.437	0.099	0.299	0.293	0.455	−0.194
Other	0.299	0.458	0.114	0.318	0.342	0.474	−0.228
Industry sector							
Construction	0.053	0.225	0.029	0.169	0.059	0.236	−0.030
Manufacturing	0.147	0.354	0.098	0.297	0.158	0.365	−0.060
Sales	0.197	0.398	0.048	0.213	0.232	0.422	−0.184
Service	0.183	0.387	0.131	0.337	0.195	0.396	−0.064
Other	0.420	0.494	0.694	0.461	0.356	0.479	0.338
Regions							
East	0.419	0.493	0.424	0.494	0.418	0.493	0.006

(continued)

Table 5.1 (continued)

	Total		CPC		Non-CPC		Gap
	Mean	S.D	Mean	S.D	Mean	S.D	
Central	0.360	0.480	0.355	0.479	0.361	0.480	−0.006
West	0.221	0.415	0.221	0.415	0.221	0.415	0.000
Parent in public sector	0.049	0.215	0.101	0.301	0.037	0.188	0.064
Observations	10,611		2,009		8,602		

Source Calculated based on CHIPs 2013
Note mean values of CPC-mean values of non-CPC

First, although the wage level is lower for women than for men for both CPC members and nonmembers, the wage gap between CPC members and nonmembers is similar (female 1.347, male 1.345) for women and men.

Second, wages increase with age for CPC members, which indicates that the influence of the seniority wage system is greater for CPC members, while for non-CPC members, the relationship between the wage level and age is an inverse U shape; the lowest is at 30–39 years of age. The wage gap between CPC members and nonmembers is greater for the older group (workers aged 40 and over) than the younger group (workers aged 16–39). The wage gap is observed to increase with age.

Third, the wage level is higher for highly educated workers for both CPC and non-CPC groups, which can be explained by the human capital theory (Becker 1964; Mincer 1974). The wage gap between CPC members and nonmembers is smaller for the highly educated group than for the low- and middle-level education groups.

Fourth, the wage level is higher for managers/technicians and clerks than for other occupational groups (e.g., manufacturing worker, service worker) for both CPC and non-CPC groups. The wage gap between CPC members and nonmembers is greatest for managers/technicians; it is smallest for manufacturing workers.

Fifth, an interesting phenomenon related to ownership type is found. Excepting COEs, the wage level is higher for CPC members than nonmembers in the public sector (PUB), FOEs, POEs, and others. The wage level in the FOEs is highest for both CPC members and nonmembers. The wage gap between CPC members and nonmembers is greater for privately owned enterprises (1.411) and the public sector (1.302).

Sixth, the wage level is higher for CPC members than for nonmembers in each industry sector. The wage gap between CPC members and nonmembers is greater for the manufacturing industry and sales industry sectors than for other sectors.

It is also observed that wage levels differ by group, which means that individual characteristics (gender, age, educational attainment) and job (occupation, ownership type of enterprises, industry sector) may affect the wage level for both CPC members and nonmembers. The wage gap between these two groups is shown to be greater for workers who are older, less-educated, in the manager and technician group, in the manufacturing industry and sales industry sectors, and in the public sector and

Table 5.2 Wage gaps between CPC members and nonmembers by group

	CPC	Non-CPC	Gap
	(A)	(B)	A/B
Gender category			
Female	19.783	14.689	1.347
Male	24.396	18.135	1.345
Age category			
Aged 16–29	18.341	14.323	1.281
Aged 30–39	22.240	18.011	1.235
Aged 40–49	23.134	16.900	1.369
Aged 50–60	23.841	16.548	1.441
Education category			
Primary	12.211	11.703	1.043
Junior high school	20.315	13.562	1.498
Senior high school	18.532	15.978	1.160
College	21.263	19.054	1.116
University	27.267	26.501	1.029
Occupation category			
Manager and engineer	29.038	22.722	1.278
Clerk	22.408	18.623	1.203
Manufacturing worker	18.840	15.961	1.180
Service worker	16.000	13.295	1.203
Other	19.436	15.346	1.267
Ownership category			
PUB	24.460	18.792	1.302
COEs	16.631	17.086	0.973
FOEs	30.564	23.890	1.279
POEs	22.425	15.889	1.411
Other	16.299	14.549	1.120
Industry category			
Construction	21.436	20.230	1.060
Manufacturing	22.849	16.166	1.413
Sales	19.207	13.624	1.410
Service	19.633	16.015	1.226
Other	23.925	18.248	1.311

Source Calculated based on CHIPs 2013
Note The age is limited from 16 to 59 years old. Hourly wage in each group is used in calculations

privately owned enterprises. Therefore, these factors should be considered when we analyze the wage gap between CPC members and nonmembers.

5.4 Econometric Analysis Results

5.4.1 Determinants of Participation in the CPC Organization

Table 5.3 reports the determinants of participation in the CPC organization based on the probit regression model. Five kinds of analyses (Model 1–5) are employed based on the utilizations of various independent variables. The margin effects are shown in Table 5.3.

First, when the other factors are held constant, the probability of becoming a CPC member is 7.3–8.6% points lower for female workers than for male workers. This indicates a remaining gender gap in the probability of participating in the CPC organization.

Second, as compared with the youth group and the low-level education group, the probability of becoming a CPC member is higher for the middle- and older-aged group and for the middle-level and highly educated groups.

Third, the probability of participating in the CPC organization differs by ownership sector. For example, based on the results of Model 5, as compared with workers in the public sector (PUB), the probability of becoming a CPC member is 2.4%, 10.5%, or 10.7% points lower for the workers in the private sector (COEs, FOEs, or POEs, respectively). In addition, the probability of participating in the CPC organization differs by occupation. For example, when other conditions remain constant, the possibility of becoming a CPC member is lowest for manufacturing workers, while it is highest for clerks.

Fourth, it should be noted that having parents in the public sector may positively affect the statistical probability of becoming a CPC member. As is well known, the influence of the CPC is greater in the public sector than in the private sector; when the parents are in the public sector, their children may easily earn loyalty from the CPC, obtain more information about the CPC organization, and gain more political social capital from their parents, which may increase their probability of becoming a CPC member. The results suggest that the intergenerational transference of CPC membership between parents and their children remains, which may cause the intergenerational transference of social economic status. Based on the results, we utilize the parent in the public sector as an identification variable to calculate the sample election bias and adjust items in the following estimations.

Table 5.3 Results of probability of participation into the CPC organization

	(1)		(2)		(3)		(4)		(5)	
	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value
Female	−0.086***	−11.27	−0.077***	−11.05	−0.081***	−11.60	−0.073***	−10.85	−0.073***	−10.90
Age (Aged 16–29)										
Aged 30–39	0.093***	7.10	0.082***	6.80	0.074***	6.15	0.065***	5.59	0.065***	5.60
Age 40–49	0.097***	7.83	0.156***	12.93	0.146***	12.19	0.112***	9.76	0.112***	9.73
Age 50–59	0.154***	10.59	0.284***	18.12	0.258***	16.56	0.206***	13.87	0.203***	13.65
Education (Primary)										
Junior high school			0.188***	5.40	0.176***	5.14	0.145***	4.45	0.144***	4.44
Senior high school			0.363***	9.72	0.326***	8.90	0.264***	7.57	0.261***	7.50
College			0.583***	13.49	0.508***	11.82	0.407***	9.77	0.404***	9.71
University			0.752***	17.82	0.681***	15.63	0.570***	12.94	0.565***	12.84
Occupation (Manufacturing worker)										
Manager and engineer					0.061***	4.92	0.045***	3.62	0.044***	3.54
Clerk					0.202***	13.18	0.164***	10.6	0.162***	10.48
Service worker					0.007	0.62	0.051***	3.79	0.050***	3.73
Other					0.040***	2.87	0.057***	3.85	0.055**	3.71
Ownership (PUB)										
COE							−0.026*	−1.83	−0.023***	−1.67
FOE							−0.105***	−7.18	−0.105***	−7.12
POE							−0.107***	−12.96	−0.107***	−12.89
Other							−0.078***	−8.32	−0.076*	−8.14

(continued)

Table 5.3 (continued)

	(1)		(2)		(3)		(4)		(5)	
	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value	dF/dx	z-value
Industry sector (Manufacturing)										
Construction							−0.028*	−1.63	−0.028***	−1.63
Sales							−0.078***	−5.8	−0.077***	−5.79
Service							−0.017	−1.36	−0.018***	−1.38
Other							0.006	0.52	0.005***	0.39
Region (West)										
Central	−0.005	−0.630	0.023***	2.89	0.023***	2.99	0.002	0.33	0.002**	0.27
West	0.000	0.030	0.038***	3.96	0.037***	3.97	0.022**	2.49	0.022***	2.47
Parents in public sector									0.066***	4.37
Observations	10,755		10,755		10,755		10,755		10,755	
Pseudo R2	0.026		0.191		0.215		0.254		0.259	
Log likelihood	−5072.898		−4214.058		−4087.489		−3884.150		−3860.729	

Source Calculated based on CHIPs 2013
Note (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Estimated based on the probit regression model

5.4.2 Wage Premium of CPC Membership by Gender

To investigate the wage premium of CPC membership, the wage functions are estimated. Estimation 1 is based on pooling OLS; Estimation 2 utilizes the Heckman two-step model to address the sample selection bias problem. The results using total samples including both female and male workers are summarized in Table 5.4.[14] Four kinds of analyses are employed by using various independent variables. We add more independent variables from Model 1 to Model 4. Concretely, Model 1 utilizes only one—the CPC member dummy variable as the independent variable; the independent variables in Model 2 include CPC membership, female, years of experience, and educational variables; Model 3 adds new variables—the occupation, industry sector, and region variables—to the variables of Model 2; Model 4 adds a new variable—the parents in the public sector dummy variable—to the variables of Model 3. The main findings are as follows.

First, based on the results in Estimation 1 (OLS), when other conditions are not controlled, the wage premium of CPC membership is 32.2% points, which is statistically significant at a 1% level (Model 1). When we control the individual characteristics (gender, education, years of experience), the wage premium of CPC membership decreases greatly to 4.3% points, which is statistically significant at a 5% level (Model 2). However, when job factors (occupation, industry sector) are controlled, the wage premium of CPC membership is not statistically significant (Model 3). The results indicate that work conditions such as the occupation or industry sector may greatly influence the wage premium of CPC membership.

Second, based on the results in Estimation 2 (Heckman two-step), when the sample selection bias is adjusted, the wage premium of CPC membership is not statistically significant in the whole models, and the coefficients of selection items are statistically

Table 5.4 Wage premium of CPC membership (total samples)

		(1)	(2)	(3)	(4)
Estimation 1	CPC	0.322***	0.043**	0.024	0.023
		(17.18)	(2.22)	(1.20)	(1.14)
Estimation 2	CPC	0.020	0.025	0.025	0.024
		(0.97)	(1.20)	(1.23)	(1.21)
	Adjusted	0.760***	0.124***	−0.013	−0.035
	Item	(28.89)	(3.00)	(−0.25)	(−0.48)

Source Calculated based on CHIPs 2013
Note (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Model 1 uses only one-the CPC member dummy variable as the independent variable; the independent variables in Model 2 includes the CPC membership, female, years of experience and education variables; the Model 3 is the one added the new variables—the occupation, industry sector and regions variables to the variables of Model 2; the Model 4 is the one added the new variables—the parents in the public sector dummy variable to the variables of Model 3
(3) t-values are expressed in parentheses

significant at a 1% level in both Model 1 and Model 2. The results suggest that selection bias problem remains in the OLS results; thus, it is necessary to consider this bias in the estimations of wage function and wage decomposition.

To compare the wage premium of CPC membership of female and male workers, we conducted the estimations by gender; these results are summarized in Table 5.5 (female) and Table 5.6 (male). The main new findings are as follows.

First, the wage premium of CPC membership is around 34.7% points for female workers and 4.8–30.8% points for male workers. However, when the job factor and selection items are controlled, the impact of CPC membership on wages is not

Table 5.5 Wage premium of CPC membership for female workers

		(1)	(2)	(3)	(4)
Estimation 1	CPC	0.347^{***}	0.034	0.017	0.017
		(10.63)	(1.03)	(0.50)	(0.51)
Estimation 2	CPC	−0.001	−0.005	0.002	0.007
		(−0.03)	(−0.14)	(0.06)	(0.20)
	Adjusted	1.035^{***}	0.320^{***}	0.210^{**}	0.247^{*}
	Item	(22.10)	(4.31)	(2.12)	(1.83)

Source Calculated based on CHIPs 2013
Note (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Model 1 uses only one-the CPC member dummy variable as the independent variable; the independent variables in Model 2 includes the CPC membership, female, years of experience and education variables; the Model 3 is the one added the new variables—the occupation, industry sector and regions variables to the variables of Model 2; the Model 4 is the one added the new variables—the parents in the public sector dummy variable to the variables of Model 3
(3) t-values are expressed in parentheses

Table 5.6 Wage Premium of CPC membership for male workers

		(1)	(2)	(3)	(4)
Estimation 1	CPC	0.308^{***}	0.048^{**}	0.027	0.028
		(13.58)	(2.02)	(1.13)	(1.13)
Estimation 2	CPC	0.037	0.038	0.032	0.030
		(1.44)	(1.49)	(1.29)	(1.23)
	Adjusted	0.631^{***}	0.067	−0.0628018	−0.080
	Item	(20.00)	(1.33)	(−0.90)	(−0.81)

Source Calculated based on CHIPs 2013
Note (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Model 1 uses only one-the CPC member dummy variable as the independent variable; the independent variables in Model 2 includes the CPC membership, female, years of experience and education variables; the Model 3 is the one added the new variables—the occupation, industry sector and regions variables to the variables of Model 2; the Model 4 is the one added the new variables—the parents in the public sector dummy variable to the variables of Model 3
(3) t-values are expressed in parentheses

statistically significant for female or male workers. These results are consistent with those shown in Table 5.4, suggesting that the influences on wages of job factors and selection are greater for female and male workers. In addition, for female workers, when the individual's human capital such as education and years of work experience is controlled, the significances of the impact of CPC membership on wages disappear. The results indicate that, for female workers, human capital may greatly influence the probability of becoming a CPC member.

Second, in Model 1 to Model 4, the selection items are all statistically significant for female workers, whereas the adjusted item is only statistically significant in Model 1 for male workers. This suggests that the influence of sample selection bias on wage levels is greater for female workers than for their male counterparts.

5.4.3 The Decomposition Results of the Wage Gap Between CPC and Non-CPC

Table 5.7 reports the decomposition results of wage gaps between CPC members and nonmembers for the total sample including female and male workers. Two kinds of decomposition analyses are employed. Model 1 is a decomposition analysis that excludes the selectivity items based on the wage function by the OLS model (Blinder 1973; Oaxaca 1973). Model 2 is a decomposition analysis that includes the selection items based on the wage function by the Heckman two-step model (Oaxaca and Choe 2016).[15] The main results are as follows.

First, in general, the results of Model 1 and Model are different. Concretely, based on Model 1, the contribute rate of the explained component (98.3%) on the wage gap is greater than that of the unexplained component (1.7%); however, based on Model 2, the influence of the unexplained component (92.8%) on the wage gap is greater than that of the explained part (7.2%). Particularly, the contribute rate of unexplained component of adjusted items is 170.2%, which is the largest among these factors. This suggests that the factors that determine the probability of becoming a CPC member and some unobserved factors that are not controlled in the study, such as unobserved ability, may influence the probability of becoming a CPC member, greatly affecting the wage gap. Thus, analyses that consider the sample selection bias should be employed.

Second, for the detailed decomposition results, (1) the differentials of education enlarge the wage gap, the contribution rate is 55.3% in Model 1, 43.2% in Model 2. This indicates that the differentials in human capital between CPC members and nonmembers contribute to the existence of the wage gap. Concretely, because the average educational level is higher for CPC members than for nonmembers, based on the human capital theory (Becker 1964; Mincer 1974), the wage level is higher for CPC members, which contributes to the wage gap. In addition, the contribution rate of wage determination mechanism differs between these two groups. For example, the value of the unexplained component of education is greater for CPC members (12.2%

Table 5.7 Decomposition results of wage gap between CPC and non-CPC (total samples)

	Values		%	
	Explained	Unexplained	Explained (%)	Unexplained (%)
Model 1				
Total	0.354	0.006	98.3	1.7
Female	0.030	0.020	8.3	5.6
Years of experience	0.008	−0.150	2.2	−41.7
Education	0.199	0.044	55.3	12.2
Occupation	0.052	−0.007	14.4	−1.9
Industry	0.000	−0.087	0.0	−24.2
Ownership	0.062	−0.094	17.2	−26.1
Region	0.003	−0.120	0.8	−33.3
Constants	0.000	0.400	0.0	111.1
Model 2				
Total	0.026	0.333	7.2	92.8
Selection	−0.235	0.611	−65.5	170.2
Female	0.025	0.019	7.0	5.3
Years of experience	0.006	−0.164	1.7	−45.7
Education	0.155	0.120	43.2	33.4
Occupation	0.040	−0.004	11.1	−1.1
Industry	0.041	−0.100	11.4	−27.9
Ownership	−0.008	−0.094	−2.2	−26.2
Region	0.002	−0.119	0.6	−33.1
Constants	0.000	0.064	0.0	17.8

Source Calculated based on CHIPs 2013
Note Estimation 1 based on Blinder-Oaxaca model; Estimation 2 based on Oaxaca and Choe model

in Model 1, 33.4% in Model 2), suggesting that the return on education is greater for CPC members than for nonmembers, which expands the wage gap between these two groups. The results indicate that both the gap of educational attainment and the return on education may cause the wage gap between CPC members and nonmembers in China.

(2) The gender proportion may increase the wage gap (8.3% in Model 1, 7.0% in Model 2). The results can be explained as follows. Because the gender wage gap remains (Gustafsson and Li 2000; Maurer-Fazio and Hughes 2002; Demurger et al. 2007; Li et al. 2011; Ma 2018a, c), when the female proportion is higher for non-CPC members, the average wage may be lower for non-CPC members than for their counterparts, which may cause the wage gap between CPC members and nonmembers. In China, as shown by the slogan "women can hold up half of the sky," the government implemented gender equality employment policies and greatly

promoted female employment in the public sector (Ma 2018a). However, the proportion of females in the CPC is smaller than that of males, which may be caused by discrimination against women or women's own choices (self-selection).

(3) The differentials of occupational distributions between these two groups may cause the existence of the wage gap (14.4% in Model 1, 11.1% in Model 2). In addition, the differentials of industry sector distributions between these two groups increase the wage gap (11.4% in Model 2).

(4) Regarding enterprise ownership, the differentials of distributions of ownership types increase the wage gap (17.2% in Model 1), whereas when sample selection bias is considered, its influence decreased (−2.2% in Model 2). This indicates that the ownership sector may influence the probability of participating in the CPC; thus, the ownership effect on the wage gap is absorbed by the selection item.

Tables 5.8 and 5.9 report the decomposition results of wage gaps between CPC members and nonmembers for female workers and male workers separately. The new findings are as follows.

Table 5.8 Decomposition results of wage gap between CPC and non-CPC (female workers)

	Values		%	
	Explained	Unexplained	Explained (%)	Unexplained (%)
Model 1				
Total	0.419	−0.067	119.0	−19.0
Years of experience	−0.012	0.053	−3.4	15.1
Education	0.309	0.394	87.8	111.9
Occupation	0.064	−0.047	18.2	−13.4
Industry	0.052	−0.065	14.8	−18.5
Ownership	−0.002	−0.004	−0.6	−1.1
Region	0.008	−0.116	2.3	−33.0
Constants	0.000	−0.282	0.0	−80.1
Model 2				
Total	−0.469	0.823	−132.5	232.5
Selection	−0.711	1.318	−200.8	372.3
Years of experience	−0.003	−0.030	−0.8	−8.5
Education	0.212	0.455	59.9	128.5
Occupation	0.041	−0.048	11.6	−13.6
Industry	0.005	−0.040	1.4	−11.3
Ownership	−0.021	−0.011	−5.9	−3.1
Region	0.008	−0.117	2.3	−33.1
Constants	0.000	−0.705	0.0	−199.2

Source Calculated based on CHIPs 2013

Note Estimation 1 based on Blinder-Oaxaca model; Estimation 2 based on Oaxaca and Choe model

Table 5.9 Decomposition results of wage gap between CPC and non-CPC (male workers)

	Values		%	
	Explained	Unexplained	Explained (%)	Unexplained (%)
Model 1				
Total	0.273	0.035	88.6	11.4
Years of experience	0.017	−0.266	5.5	−86.4
Education	0.158	−0.226	51.3	−73.4
Occupation	0.043	0.015	14.0	4.9
Industry	0.046	−0.089	14.9	−28.9
Ownership	0.008	−0.15	2.6	−48.7
Region	0.001	−0.128	0.3	−41.6
Constants	0.000	0.879	0.0	285.4
Model 2				
Total	−0.120	0.426	−39.2	139.2
Selection	−0.266	0.598	−86.9	195.4
Years of experience	0.011	−0.359	3.6	−117.3
Education	0.097	−0.233	31.7	−76.1
Occupation	0.023	0.002	7.5	0.7
Industry	0.016	−0.067	5.2	−21.9
Ownership	−0.002	−0.150	−0.7	−49.0
Region	0.001	−0.130	0.3	−42.5
Constants	0.000	0.765	0.0	250.0

Source Calculated based on CHIPs 2013
Note Estimation 1 based on Blinder-Oaxaca model; Estimation 2 based on Oaxaca and Choe model

First, in general for both female and male workers, when the sample selection bias is controlled, the contribute rate of unexplained component increases from −19.0 to 232.5% (female) and from 11.4 to 139.2% (male); the range of the increase of the unexplained component is greater for female workers than for male workers. This indicates that the factors influencing the self-selection or being selected to participate in the CPC organization greatly affect the wage gap; the influence is greater for female workers than for male workers.

Second, for the detailed decomposition results, (1) although education contributes to the existence of the wage gap for both female workers and male workers, the effect of education is greater for female workers than for male workers. For example, based on Decomposition 2, the calculated values of education are 59.9% (explained component) and 128.5% (unexplained component) for female workers and 31.7% (explained component) and −76.1% (unexplained component) for male workers. The educational attainment gap may be found to enlarge the wage gap between CPC members and nonmembers for both female workers and male workers, and the

difference in the return on education for wages may enlarge the wage gap for female workers while reducing it for male workers.

(2) The differentials in occupational distribution between these two groups may increase the wage gap between CPC members and nonmembers for both female and male workers. For example, based on the explained part results of Decomposition 2, the calculated values of occupation are 11.6% for female workers and 7.5% for male workers. This demonstrates that the influence of differentials in occupational distributions on the wage gap is greater for female workers than for male workers.

(3) The differentials in distributions among industry sectors between these two groups may increase the wage gap between CPC members and nonmembers for both female and male workers, and the influence of the differentials in occupational distributions on the wage gap is greater for female workers than for male workers. Concretely, based on the explained part results of Decomposition 2, the calculated values of industry are 11.4% for female workers and 5.2 percent for male workers.

5.5 Conclusions

Using data from the Chinese Household Income Project survey (CHIPs) conducted in 2014, this study employs an empirical study based on the wage function considering the sample selection bias (Heckman 1979), the probit regression model, and the Blinder-Oaxaca decomposition model (Blinder 1973; Oaxaca 1973; Oaxaca and Choe 2016) to (1) estimate the determinants of participation in the CPC, (2) estimate the impact of CPC membership on wage levels, and (3) investigate the determinants of the wage gap between CPC members and nonmembers in China. We mainly compare the differences in these factors between female and male workers.

Fourth, new findings emerge. First, when the other factors are constant, the probability of becoming a CPC member is 7.3–7.7% points lower for female workers than for male workers. This indicates that a gender gap of participation in the CPC remains.

Second, the wage premium of CPC membership is higher for female workers (around 34.7% points) than for male workers (4.8–30.8% points), and the influence of selection bias on wage levels is greater for female workers than for male workers.

Third, for both female workers and male workers, when the sample selection bias is controlled, the contribution rate of the unexplained component increases from − 19.0 to 232.5% (females) and from 11.4 to 139.2% (males); the range of increase of the unexplained component is greater for female workers than for male workers. This indicates that factors influencing self-selection or being selected to become a CPC member greatly affect the wage gap, and the influence is greater for female workers than for male workers.

Fourth, the decomposition results show that, excepting the sample selection bias, endowment differentials—such as differences in years of schooling and distributions of occupations and industry sectors—are the main factors affecting the wage gap for

both female and male workers, and the contribution of endowment differentials is greater for female workers than for male workers.

The results indicate that, in the 2000s, CPC membership positively affected wage levels for both female and male workers, and the wage premium of CPC membership was greater for female workers than for male workers. The decomposition results show that, excepting the selection bias, endowment differentials—including human capital—are the main factors contributing to the wage gap between CPC members and nonmembers, and the influence is greater for female workers than for male workers. This suggests that, as the market-oriented economy reform advances, the influence of market mechanisms on wage determination becomes greater. Although the CPC leadership remains dominant in the political sphere, the influence of market mechanisms on wage determination increased; therefore, endowment differentials become the main factor contributing to the wage gap. It can be expected that, with the progress of market-oriented economy reform, the influence of unexplained component—including discrimination against non-CPC members—on the wage gap may decrease, and the influence of differences in the explained component (endowment differentials)—including human capital—may increase for both female and male workers. However, it should be noted that, in general, when other factors are constant, the probability of becoming a CPC member is lower for female workers than for male workers, and the influence of sample selection bias on wages is greater for female workers than for their male counterparts. This suggests that there may be discrimination against female workers participating in the CPC organization. Moreover, it also may be argued that the wage data used in this analysis only include basic wages, bonuses, and allowances that are reported. It is well known that some parts of income, such as income derived from corruption, may not be reported and cannot be measured, possibly causing the income gap between CPC members and nonmembers to be underestimated.

Notes

1. Since 1949, the CPC has been the dominant party leading the national organization of China. Article 29 of the Constitution of the Communist Party of China stipulates that "China is led by the Communist Party of China." For details on CPC organization, criteria and the selection process for joining the CPC, and the role of the CPC in Chinese firms, please refer to Ma and Iwasaki (2021).
2. For the survey and meta-analysis on communist party membership and the wage premium in China, please refer to Ma and Iwasaki (2021).
3. Based on Section 1 Article 1 of the Constitution, prospective members of the Communist Party of China must meet five prerequisites. They must be: (1) blue collar workers, farmers, white collar workers, and other revolutionary activists who are Chinese citizens older than 18 years of age; (2) those who accept the party's program and constitution; (3) those who are willing to join and work actively in one of the party organizations; (4) those who enforce the party's resolutions; (5) those who regularly pay Communist Party of China membership dues. Even though these five conditions could be met by the majority of Chinese

citizens, the selection process for becoming a CPC member is strict and long (Hu and Zhou 1998; Li and Zhang 2003).

4. Regarding individual characteristics (e.g., education, gender), in fact, CPC members in China can be considered an elite class. For example, based on reports from the China Xinhua News Network Corporation, the proportion of higher education graduates among all CPC members is 45.9%.
5. In order to simplify the expression of equations, all constant items are omitted.
6. In the Blinder-Oaxaca decomposition model (Blinder 1973; Oaxaca 1973), the adjusted item (λ) is not considered.
7. It is debated whether an index number problem exists in the Blinder-Oaxaca decomposition model. Estimated results may vary with the kinds of groups compared. Given the space constraints, and because the two sets of decomposition results are almost identical, only estimated results using Eq. (5.4) are presented in this study.
8. The mandatory retirement ages are as follows: 45 for a female worker, 50 for a male worker, 55 for a female cadre, and 60 for a male cadre.
9. Variable values in the range of the mean value $\pm$ three times S.D. are defined as abnormal values here.
10. Years of experience = age $-$ years of schooling -6.
11. Gustafsson and Li (2000), Demurger et al. (2007), and Ma (2018c) analyzed the gender wage gaps in China based on decomposition methods and found that discrimination against women is the main factor contributing to the existence of the gender wage gap.
12. There are 16 industry categories in the survey for local urban residents in CHIPs 2013. To confirm the analyzed samples, we reclassified the industrial sectors into five kinds.
13. For empirical studies on the wage gap between the public sector and the private sector in China, please refer to Zhang and Xue (2008), Ye et al. (2011), Demurger et al. (2012), and Ma (2018c).
14. For detailed results, please see Appendix Tables 5.10 and 5.11.
15. The results of the wage function by the OLS model and the Heckman two-step model are shown in the Tables 5.12 and 5.13.

Appendix

See Tables 5.10, 5.11, 5.12 and 5.13.

Table 5.10 Results of wage functions of CPC and non-CPC (OLS)

	(1) CPC		(2) Non-CPC		(3) Gap
	Coef.	t-value	Coef.	t-value	
Female	−0.208***	−6.42	−0.252***	−16.03	0.044
Exp	0.025***	3.39	0.043***	12.61	−0.018
Exp.-sq	−0.000**	−2.26	−0.001***	−11.77	0.001
Education (Primary)					
Junior high	0.057	0.25	0.036	1.08	0.021
Senior high	0.297	1.33	0.189***	5.37	0.108
College	0.447**	1.99	0.414***	10.28	0.033
University	0.654***	2.89	0.658***	14.92	−0.004
Occupation (Manufacturing)					
Manager/engineer	0.130**	2.22	0.137***	5.09	−0.007
Clerk	0.010	0.16	0.013	0.42	−0.003
Service worker	−0.140**	−2.06	−0.126***	−4.80	−0.014
Other	−0.102	−1.47	−0.119***	−4.17	0.017
Ownership (PUB)					
COEs	−0.284***	−3.81	−0.001	−0.02	−0.283
FOEs	0.306**	2.12	0.266***	5.71	0.04
POEs	−0.139**	−2.52	−0.017	−0.75	−0.122
Other	−0.184***	−3.34	−0.047**	−1.99	−0.137
Industry sector (Manufacturing)					
Construction	−0.0195	−0.20	0.253***	6.74	−0.273
Sales	−0.044	−0.50	0.019	0.61	−0.063
Service	−0.079	−1.17	−0.002	−0.06	−0.077
Other	−0.041	−0.72	0.080***	2.99	−0.121
Region (East)					
Central	−0.399***	−11.78	−0.168***	−9.52	−0.231
West	−0.306***	−7.84	−0.143***	−7.00	−0.163
Constants	1.916***	7.56	1.517***	23.60	0.399
Observations	2,009		8,602		
Adj R-squared	0.224		0.237		

Source Calculated based on CHIPs 2013
Note $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$; Gap = CPC-Non-CPC

Table 5.11 Results of wage functions of CPC and non-CPC (Heckman two-step model)

	(1) CPC		(2) Non-CPC		(3) Gap
	Coef.	t-value	Coef.	t-value	
Female	−0.171***	−4.05	−0.212***	−7.85	0.041
Exp	0.020**	2.42	0.040***	9.98	−0.020
Exp.-sq	−0.000*	−1.80	−0.001***	−11.20	0.001
Education (Primary)					
Junior high	0.044	0.20	−0.045	−0.81	0.089
Senior high	0.248	1.10	0.054	0.66	0.194
College	0.362	1.56	0.236**	2.26	0.126
University	0.510**	2.06	0.430***	3.29	0.080
Occupation (Manufacturing)					
Manager/engineer	0.112*	1.89	0.116***	3.94	−0.004
Clerk	−0.059	−0.78	−0.050	−1.06	−0.009
Service worker	−0.162**	−2.34	−0.149***	−5.04	−0.013
Other	−0.129*	−1.81	−0.143***	−4.44	0.014
Ownership (PUB)					
COEs	−0.267***	−3.52	0.011	0.28	−0.278
FOEs	0.392**	2.51	0.360***	5.17	0.032
POEs	−0.085	−1.26	0.050	1.17	−0.135
Other	−0.146**	−2.39	−0.004	−0.12	−0.142
Industry sector (Manufacturing)					
Construction	−0.011	−0.11	0.270***	7.01	−0.281
Sales	−0.012	−0.14	0.070*	1.68	−0.082
Service	−0.070	−1.03	0.007	0.24	−0.077
Other	−0.045	−0.78	0.077***	2.88	−0.122
Region (East)					
Central	−0.400***	−11.78	−0.169***	−9.58	−0.231
West	−0.317***	−7.98	−0.155***	−7.25	−0.162
Adjusted item	0.198	1.42	−0.132*	−1.84	0.330
Constants	1.992***	7.69	1.928***	8.28	0.064
Observations	2,009		8,602		
Adj R-squared	0.2248		0.187		

Source Calculated based on CHIPs 2013
Note $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$; Gap = CPC-Non-CPC

Table 5.12 Results of wage premium of CPC membership

	(1)		(2)		(3)		(4)	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
CPC	0.322***	17.18	0.043**	2.22	0.023	1.20	0.023	1.14
Female	−0.251***	−16.94	−0.275***	−19.63	−0.248***	−17.54	−0.247***	−17.53
Exp			0.042***	13.42	0.039***	12.64	0.0400***	12.86
Exp.-sq			−0.000***	−11.85	−0.001***	−11.42	−0.001***	−11.62
Education (Primary)								
Junior high school			0.063*	1.92	0.055*	1.69	0.048	1.50
Senior high school			0.272***	8.07	0.231***	6.90	0.212***	6.27
College			0.544***	14.84	0.448***	12.04	0.418***	11.07
University			0.839***	21.87	0.683***	17.13	0.645***	15.84
Occupation (Manufacturing)								
Manager and engineer					0.143***	5.95	0.141***	5.86
Clerk					0.025	0.95	0.020	0.75
Service worker					−0.138***	−5.72	−0.124***	−5.08
Other					−0.125***	−4.75	−0.114***	−4.29
Industry sector (Manufacturing)								
Construction					0.200***	5.77	0.231***	6.62
Sales					−0.008	−0.30	0.018	0.63
Service					−0.024	−0.90	−0.002	−0.08
Other					0.059**	2.52	0.070***	2.87
Ownership (PUB)								

(continued)

Table 5.12 (continued)

	(1)		(2)		(3)		(4)	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
COEs							−0.054	−1.55
FOEs							0.246***	5.61
POEs							−0.043**	−2.10
Other							−0.075***	−3.46
Region (East)								
Central	−0.260***	−15.65	−0.219***	−13.99	−0.217***	−13.93	−0.213***	−13.58
West	−0.248***	−12.93	−0.188***	−10.32	−0.179***	−9.88	−0.177***	−9.79
Constants	2.388***	174.09	1.472***	27.86	1.567***	28.71	1.583***	26.83
Observations	10,611		10,611		10,611		10,611	
Adj R-squared	0.082		0.188		0.211		0.215	

Source Calculated based on CHIPs 2013
Notes (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Gap = coef. of CPC-coef. of non-CPC

Table 5.13 Results of wage premium of CPC membership including adjusted items

	(1)		(2)		(3)		(4)	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
CPC	0.020	0.97	0.025	1.20	0.025	1.23	0.0242	1.21
Female	−0.166***	−11.45	−0.261***	−17.57	−0.250***	−16.01	−0.252***	−15.07
Exp			0.039***	12.06	0.039***	11.95	0.040***	12.05
Exp.-sq			−0.001***	−11.22	−0.001***	−11.21	−0.001***	−11.39
Education (Primary)								
Junior high school			0.047	1.43	0.056*	1.71	0.052	1.57
Senior high school			0.236***	6.57	0.235***	6.51	0.219***	5.93
College			0.481***	11.35	0.453***	10.49	0.430***	9.51
University			0.738***	14.46	0.692***	12.73	0.666***	11.17
Occupation (Manufacturing)								
Manager and engineer					0.144***	5.92	0.143***	5.84
Clerk					0.029	0.94	0.030	0.89
Service worker					−0.138***	−5.66	−0.121***	−4.87
Other					−0.125***	−4.71	−0.111***	−4.13
Industry sector (Manufacturing)								
Construction					0.199***	5.71	0.229***	6.51
Sales					−0.010	−0.34	0.015	0.51
Service					−0.025	−0.91	−0.004	−0.14
Other					0.060**	2.52	0.070***	2.88
Ownership (PUB)								

(continued)

Table 5.13 (continued)

	(1)		(2)		(3)		(4)	
	Coef.	t-value	Coef.	t-value	Coef.	t-value	Coef.	t-value
COEs							−0.057*	−1.61
FOEs							0.235***	4.77
POEs							−0.051*	−1.93
Other							−0.081***	−3.21
Region (East)								
Central	−0.255***	−15.96	−0.223***	−14.19	−0.216***	−13.86	−0.213***	−13.58
West	−0.246***	−13.33	−0.194***	−10.62	−0.178***	−9.72	−0.176***	−9.61
Adjusted item	0.760***	28.89	0.124***	3.00	−0.013	−0.25	−0.0349	−0.48
Constants	2.158***	139.92	1.530***	27.20	1.562***	26.20	1.577***	26.19
Observations	10,611		10,611		10,611		10,611	
Adj R-squared	0.149		0.196		0.211		0.215	

Source: Calculated based on CHIPs 2013
Notes (1) $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$
(2) Gap = coef. of CPC-coef. of non-CPC

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Chapter 6
Gender Gap in Volunteer Activity Participation

Abstract Using the longitudinal data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015, this study investigates the determinants of participation in volunteer activity of individuals aged 45–69 in China; it also compares differences in the determinants by gender. The random effects model and instrumental variables method are used to address unobserved heterogeneity and other endogeneity problems. The results indicate that when other factors are held constant, the gender gap in the probability of participating in volunteer activity is smaller. Second, to compare differences in the mechanisms for participating in volunteer activity by gender, we found that six factors (market work, education, income, family care, age, health status) are broadly supported for women and men, but the influence of determinant factors is different by gender.

Keywords Gender gap · Volunteer activity · Participation · China

6.1 Introduction

Research suggests that, in many developed countries, volunteer activity[1] is an important part of social life, and volunteer activity improves individuals' well-being (happiness or health status) and increases social capital and community development (Growiec and Growiec 2014; Rodriguez-Pose and Berlepsch 2014; Aranpatzi et al. 2018; Ma et al. 2020; Ma 2020). Some previous studies have analyzed the determinants of participation in volunteer activity in developed countries and analyzed nonprofit organizations in China (McCabe and Deng 2018; Pei et al. 2018; Liu and Dong 2018; Dong et al. 2019; Li 2019; Liu and Wang 2019). Yet empirical studies of individuals' behavior in participating in volunteer activity for China using national longitudinal survey data are limited, and the studies on the gender gap in volunteer activity participation are scare. This study can fill the gaps.

Volunteering may be a beneficial activity for older adults. It gives them a connection to people, a usefulness to others they may value, and a purpose in life that may improve their self-esteem and mental and physical health. Notably, in China, the mandatory retirement age for men is 60 for both worker (blue collar worker) and cadre (white collar worker); For women, it is 50 (for a worker) and 55 (for a cadre).

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Retired people usually have more disposable time than workers, it can be expected that the probability of participating in volunteer activity may be higher for retired individuals than for working individuals. The issue becomes even more relevant because China is experiencing the quick population aging. Using a national longitudinal survey, this study investigates the determinants of participation in volunteer activity of individuals aged 45–69 years old in China and compares the results by gender.

The remainder of this chapter is as follows. Section 6.2 summarizes the previous empirical studies on the issue and discusses the influences of main factors on participation in volunteer activity. Section 6.3 gives the framework of the empirical analysis, including models and datasets. Section 6.4 introduces the empirical results and compares them by gender. Section 6.5 summarizes the conclusions.

6.2 Literature Review

6.2.1 Theories and Empirical Studies on the Determinants of Participation in Volunteer Activity

Theoretical frameworks[2] on the determinants of participation in volunteer activities can be summarized from three perspectives: (i) psychological theories that emphasize personality traits, self-concepts, and motivations (Handy and Cnaan 2007; Einolf 2008; Gronlund 2011); (ii) sociological theories that focus on individual sociodemographic characteristics such as race, gender, social class, and social network (or social capital); and (iii) economics theories based on the altruistic behavior of "not for oneself but for someone else" (Becker 1974, 1976, 1981, 1991, 1985a, 1985b; Barro 1974; Andreoni 1989, 1990; Sen 1982; Haski-Leventhal 2009), and those based on selfish behavior. The consumption model is based on a utility function, in which volunteer activities are treated as a consumer good that is similar to leisure in neoclassic economics (Menchik and Weisbrod 1987; Freeman 1997; Yamauchi 2001).

This study is mainly based on the economics theories. Previous studies[3] of developed countries have shown that volunteer participation is influenced by work status, educational background, household income, family care, age, health status, and other factors (i.e., gender, community).

However, empirical studies on the issue for China are scarce; three papers deal with the issue. Concretely, using a cross-sectional community survey conducted in 2008 in Shanghai, Tong et al. (2018) examined the probability of participation into formal social participation among elderly single-person household and the association between the utilization of community-based services and formal social participation. They found that the use of community-based services is significantly associated with formal social participation among elderly single-person household. The results also indicate that the age and number of chronic illnesses may negatively

affect the probability of participation into social activity. Using data from the 2012 Chinese General Social Survey (CGSS), Lin (2019) investigated the impact of social capital (social trust, bridging networks, civic engagement, organizational activism, informal networks) on individual charitable donations and volunteer activity and found that social capital may affect individual charitable behaviors in China. Using a representative dataset from the 2013 Survey on Philanthropic Behaviors of Urban Citizens in China, Wu et al. (2018) constructed five social capital indices (civic network, reciprocal norms, institutional trust, acquaintance trust, and stranger trust) to investigate the influence of social capital on volunteer activity in urban China; he found that civic network, norms of reciprocity, institutional trust, and stranger trust are positively associated with both volunteer activity and charitable donation, while acquaintance trust is negatively correlated with charitable donation but has no significant association with volunteer activity in China.

6.2.2 Gender Gap of Volunteer Activity Participation

The gender gap observed in volunteer activity participation may be considered according to two channels of influence.

First, volunteer activity participation can be considered a form of leisure. According to the neoclassic economics, there is a trade-off relationship between market work and leisure (e.g., volunteer activity). Gender role segregation, expressed as "men for work, women for family," means that women have fewer hours for market work. Therefore, it is assumed that the probability of participating in volunteer activity is higher for women than for men (positive effect). Previous studies have revealed that women are more likely than men to participate in volunteer activity, and women spend more time on volunteer activity. Also, people with children are more likely to take part in volunteer activity and to spend more time on volunteer activity.

Second, some factors may decrease the probability of participating in volunteer activity more for women than for men. For example, women may take more responsibility for family care and housework than men do. Consciousness of participation in social activity may be less for women than for men; therefore the probability of participating in volunteer activity may be lower for women than for men (negative effect).

Thus, from the economics theory perspective, no clear conclusions can be drawn on the issue of the gender gap in volunteer activity participation because both positive and negative effects remain. When the negative effect is greater than the positive effect, the probability of participating in volunteer activity may be lower for women than for men, or vice versa. The gender gap in volunteer activity should be estimated based on empirical studies.

6.2.3 Contributions of This Study

The three main contributions of this study can be summarized as follows. First, regarding the issue of the determinants of volunteer activity participation, comparisons with studies of developed countries are scarce for China. The results of this study may provide useful new evidence for China.

Second, the previous studies use cross-sectional data and do not address the heterogeneity problem, and this may bias the results. This study uses a longitudinal data and a random effects (RE) model to address the problem.

Third, due to time constraints, there may be an endogeneity problem between participation in market work and participation in volunteer activity; for example, the two types of behaviors may be decided simultaneously. This problem has not been considered in previous studies. This study uses instrumental variables (IV) methods to address the endogeneity problem.

Fourth, although previous studies (Wu et al. 2018; Tong et al. 2018; Lin 2019) found that a gender gap remains in the probability of volunteering, they did not investigate differences in the mechanism of volunteer activity participation by gender. This study is the first to consider differences in the determinants of volunteer activity participation by gender.

6.3 Methodology and Data

6.3.1 Model

A probit regression model is used to investigate the probability of participating in volunteer activity in Eq. (6.1).

$$\Pr(Y_i = 1) = \Pr(a_0 + \beta_{ofe} Fe_i + \beta_{0X} X_i + \upsilon_i > 0) \tag{6.1}$$

In Eq. (6.1), $\Pr(Y_i = 1)$ denotes the probability of participating in volunteer activity. i indicates individuals, Fe is a female dummy variable, and X represents the control variables. The coefficients of variables are denoted by β_{0fe} and β_{0X}. In addition, a is a constant, and υ is the error term. When β_{0fe} is statistically significant, it indicates that a gender gap remains in the probability of participating in volunteer activity.

Two econometric problems must be addressed in Eq. (6.1). First, there may be an endogeneity problem between market work and volunteer activity. Instrumental variables (IV) methods are used to address the endogeneity problem. IV methods are expressed as Eqs. (6.2.1) ~ (6.2.5).

$$\Pr(Work_i = 1) = \Pr(a_1 + \beta_{1Z} Z_i + \beta_{1fe} Fe_i + \beta_{1X} X_i + u_i > 0) \tag{6.2.1}$$

$$\Pr\left(\widehat{Work}_i = 1\right) = \Pr(a_1 + \beta_{1Z} Z_i + \beta_{1fe} Fe_i + \beta_{1X} X_i > 0) \tag{6.2.2}$$

$$Resi_i = PrWork_i - \Pr\widehat{Work}_i \tag{6.2.3}$$

$$\Pr(Y_i = 1) = \Pr(a_2 + \beta_{2Work}\widehat{Work}_i + \beta_{2fe} Fe_i + \beta_{2X} X_i + \varepsilon_i > 0) \tag{6.2.4}$$

$$\Pr(Y_i = 1) = \Pr(a_2 + \beta_{2Work} Work_i + \beta_{2Resi} Resi_i + \beta_{2fe} Fe_i + \beta_{2X} X_i + \varepsilon_i > 0) \tag{6.2.5}$$

$$corr(Z, \varepsilon) = 0 \text{ and } corr(Z, u) \neq 0$$

Based on Eqs. (6.2.1)–(6.2.5), a two-step procedure is used for estimates: (1) In the first step, we employ the probit regression model (Eq. (6.2.1)), and then calculate the imputed value of probability of participating in market work $\widehat{Work}$ (Eq. (6.2.2)) and the residual items $Resi$ (Eq. (6.2.3)). (2) In the second step, we use the imputed value of $\widehat{Work}$ or residual items $Resi$ as an explanatory variable and estimate the probability of participating in volunteer activity (Eqs. (6.2.4), (6.2.5)). Whether the estimates are unbiased hinges critically on the validity of instrumental variable (Z); that is, Z needs to be correlated with *Work* while satisfying the conditions of $corr(Z, \varepsilon) = 0$, and needs not to be correlated with $\Pr(Y_i = 1)$ ($corr(Z, u) \neq 0$). We use the formal retirement experience dummy variable as the IV. IV methods include the two-stage least squares (2SLS), the two-stage predictor substitution (2SPS), and the two-stage residual inclusion (2SRI) model. Considering that the dependent variable of participation in volunteer activity is a binary variable, 2SPS and the 2SRI models are used in this study.[7] The 2SPS model is expressed by Eq. (6.2.4), and the 2SRI model is expressed by Eq. (6.2.5).

The second econometric problem for Eq. (6.1) is the heterogeneity problem. v_i in Eq. (6.1) includes the unobserved individual-specific time-invariant effect, μ_i, and true error, δ_{it} ($v_{it} = \mu_i + \delta_{it}$). When the unobserved individual-specific time-invariant effect is not addressed, a bias may exist in the results. To address this problem, a random effects model is used. It is expressed by Eq. (6.3).

$$\Pr(Y_{it} = 1) = \Pr(a_3 + \beta_{3fe} Fe_{it} + \beta_{3X} X_{it} + \mu_i + \delta_{it} > 0) \tag{6.3}$$

Finally, to address the heterogeneity and other endogeneity problems simultaneously, a random effects (RE) probit regression model and IV methods is used. It is expressed by Eq. (6.4).

$$\Pr(Y_{it} = 1) = \Pr(a_4 + \beta_{4Work} Work_{it} + \beta_{4Resi} Resi_i + \beta_{4fe} Fe_{it} + \beta_{4X} X_{it} + \mu_i + \delta_{it}) > 0 \tag{6.4}$$

The Cragg-Donald Wald test is used as the weak instrumental variables test, and the Durbin-Wu-Hausman test is used to check for endogeneity between participation in market work and participation in volunteer activity.

To compare the differences in determinants of volunteer activity participation, we also run these models using female and male samples.

6.3.2 Data

The data for this study comes from the China Health and Retirement Longitudinal Survey (CHARLS). The CHARLS is conducted by Peking University every two years and covers representative regions of China. Its survey objects are individuals aged 45 and older. The baseline national wave of the CHARLS conducted in 2012 includes about 10,000 households and 17,708individuals in 150 counties/districts and 450 villages/resident committees. The first and second follow-up survey waves are for 2014 and 2016. Information such as demographic characteristics, family structure, intra-household transfer, employment status, income, and other related information can be obtained from the CHARLS. This study uses data from three waves (CHARLS 2011, 2013, and 2015), including the most recent data from CHARLS 2015. To consider the influence of the retirement system in government organizations and enterprises, the sample is limited to individuals aged 45–69 years. The samples used in the analysis is 28,463 (sample of participation in volunteer activity is 4,491, sample of non-participation in volunteer activity is 23,972).

6.3.3 Variable Setting

Two dependent variables are constructed as follows: first, a binary variable for work is equal to 1 when an individual is working and equal to 0 when the individual is not working. It is used in the first stage of the IV method. In China, the individuals experienced formal retirement are those who worked in the public sector (e.g., government organization, state-owned enterprises) before retriement, majority of them can receive higher public pension benefits after mandatory retirement. It can be predicted that the probability of participation work are lower for the individuals experienced formal retirement than the counterpart (who exited labor market without formal retirement experience, for example, the self-employed). On the other hand, for the individuals exiting labor market, when the other factors are constant, because the leisure hours (time constraints) may be similar regardless of formal retirement experience, the influence of formal retirement experience on participation in volunteer activity may small. Therefore, the dummy variable of formal retirement experience (1 = has experienced the formal retriement, 0 = otherwise) is used as the IV in this study. The results of the first stage of the IV method are shown in the Appendix Table 6.4. Second, a binary variable for participation in volunteer activity is equal to 1 and equal to 0 when the individual is not participating in volunteer activity.

Based on the CHARLS questionnaire item "Have you done any of these activities in the last month," when the respondent chooses "done volunteer or charity work," "cared for a sick or disabled adult not coresident with you," or "provided help to family, friends, or neighbors not coresident with you," it qualifies as participation in volunteer activity.[8]

The main independent variables are conducted as follows. First, a female dummy variable is constructed to estimate the gender gap in volunteer activity participation.

Second, a set of variables of six factors are used as follows:

Market work

Based on the individual utility function in neoclassic economics theory, there is a trade-off relationship between market work and volunteer activity.[4] It is expected that the probability of participating in volunteer activity is lower for the working group than for the non-working group because of time constraints. Carlin (2001) found that time spent on volunteer activity decreases as working hours increase. For Japan, Atoda et al. (1999), Atoda and Fukushige (2000), Yamauchi (2001), Ono (2006), and Moriyama (2007) reported that the probability of participating in volunteer activity is inversely proportionate to the householder's working hours and working days. Although the labor force participation rate of women and men is higher for China than for other countries, the labor force participation rate for middle-aged women has decreased during the current period. It is assumed that there remains a trade-off relationship between labor market work and volunteer activity. The dummy variable of work is equal to 1 when an individual is working and equal to 0 when the individual is not working;

Education

Some research has demonstrated that educational background has a strong influence on participation in volunteer activity, and that persons with a higher level of education are more likely to volunteer (Vaillancourt 1994; Freeman 1997; Ma and Ono 2013; Wu et al. 2018; Tong et al. 2018; Lin 2019). This can be explained by the human capital theory (Becker 1964). It may also be that social contribution consciousness differs among different educational attainment groups. For example, Carlin (2001) found that the higher the market wage (higher educational attainment) of married women, the more they volunteer (probability of participating in volunteer activity, volunteer activity hours). It also can be expected that educational attainment may affect volunteer activity. There educational attainment level dummy variables—low, middle, and high education levels[9] were used.

Income factors

Menchik and Weisbrod (1987) employed an empirical study to investigate the mechanism of participation in volunteer activity based on the consumption model. Menchik and Weisbrod (1987), Vaillancourt (1994), Ma and Ono (2013), Tong et al. (2018), and Lin (2019) found that the higher the unearned income, the longer the time spent on volunteer activities; conversely, the higher the market wage rate, the shorter the volunteer activity hours. Based on the consumption model advocated by Menchik

and Weisbrod (1987) and previous studies, it is assumed that the probability of participating in volunteer activity may be higher for the high-unearned income group than for the low-unearned income group in China.

Three income factor variables were constructed as: (i) the logarithmic value of the annual household consumption; (ii) the pension receipt dummy variable, which is equal to 1 when a woman is receiving a pension and equal to 0 when she is not; and (iii) the transfer to children dummy variable, which is equal to 1 when a women transfers her pension income to her children and equal to 0 when she does not.

Family care

Menchik and Weisbrod (1987), Morgan et al. (1977), and Vaillancourt (1994) found that the probability of volunteer activity tends to be lower and the hours of volunteer activity tend to be less when caring for infants.[5] In a study of married women, Carlin (2001)[6] found that the probability of participating in volunteer activity increases but the hours of volunteer activity decrease as the number of children increases. In Japan, Atoda et al. (1999), Atoda and Fukushige (2000), Yamauchi (2001), Ono (2006), Moriyama (2007), and Ma and Ono (2013) reported that the duties of family care (child care, parent care) and the number of children decrease the probability of participating in volunteer activity and the hours of volunteer activity.

Regarding family care in China, because the one-child policy had been in effect since 1979, most middle- and older aged women aged 45 and older in the survey years from 2011 to 2015 had one or two children, and most children were more than 14 years old. It can be assumed that, with an increase in the number of children, parents have more hours of work at home, which may decrease the probability of participating in volunteer activity. In contrast, family caregivers may have stronger altruistic values and greater motivation to volunteer to help others than those who are not family caregivers. It is predicted that the number of children may decrease the probability of participating in volunteer activity, but the availability of family care may increase the probability of participating in volunteer activity.

Three family factor variables were used as: (i) the number of children; (ii) the grandchildren caregiving dummy variable, which is equal to 1 when a women is caring for grandchildren and equal to 0 when she is not; and (iii) the child care giving variable, which is equal to 1 when a women is caring for children and equal to 0 when she is not.

Age

Both the probability of participating in volunteer activities and the time spent on such activities tend to change with age (Menchik and Weisbrod 1987; Vaillancourt 1994; Wu et al. 2018; Tong et al. 2018; Lin 2019). For example, for developed countries, Menchik and Weisbrod (1987) pointed out that, while the time spent on volunteer activity increases with age to a point, it decreases after the age of 43. Vaillancourt (1994) found that the most likely age for volunteering for both men and women is from age15 to 19, and that while men are more likely to participate in volunteer activities from age 25 to 54, this probability decreases between age 55 and 69. For women, the probability of participating clearly decreases at age 70 and older. In America and

Canada, participation in volunteer activities during one's student years is utilized as one aspect of socio-cultural background that may influence the employment and wages of an individual, which may reinforce an individual's participation in volunteer activities; this is known as the human capital investment theory. In China, Wu et al. (2018) and Lin (2019) reported that the probability of participating in volunteer activity decreases with age for those aged 18 and older. Tong et al. (2018) found this was also true for people aged 60 and older; the probability of participating in volunteer activity decreases with age. To consider the lifestyle and situation of middle-aged and older individuals in China, regarding the decrease in health status and social contribution efforts with age, it is assumed that the probability of participating in volunteer activity decreases with age. Regarding the retirement eligibility age for women is 50 years for workers and 55 years for cadres, we constructed three age dummy variables—age 45–49, 50–59, and 60–69 years old.

Health status

Health status as a part of human capital can influence both market work and volunteer activity. Grossman (1972) advocated a health investment model to emphasize the importance of health status for an individual. It is expected that health status may enhance participation in volunteer activity. Atoda et al. (1999) and Ma and Ono (2013) found that a healthy status increases the probability of participating in volunteer activity in Japan. In China, Tong et al. (2018) and Wu et al. (2018) found that poor health status decreases the possibility of participating in volunteer activity. Based on the human capital theory (Becker 1964) and the results of previous empirical studies, it can be assumed that the probability of participating in volunteer activity is higher for the healthy group than for the group with poor health in China. The subjective health status (poor, fair, good, very good, excellent) dummy variables were used as the indices of health status.

Other factors

Gender, marital status, environmental changes (i.e., earthquakes, natural disasters), and community factors, have also been shown to possibly affect participation in volunteer activity (Schram and Dunsing 1981; Menchik and Weisbrod 1987; Vaillancourt 1994; Atoda et al. 1999; Atoda and Fukushige 2000; Yamauchi 2001; Ono 2006; Moriyama 2007; Ma and Ono 2013). Therefore, the other factors such as gender, marital status, and regional disparity variables are also constructed as follows. (1) A female dummy variable is used to investigate the gender gap in volunteer activity participation. (2) According to the labor market segmentation hypothesis (Piore 1970), the behaviors of workers are shaped by the characteristics of the labor market. As is well known, the Chinese labor market is segmented by the population registration (*Hukou*) system. In 1958, the *Hukou* system was implemented by the government. Under the planned economy period from 1949 to 1977, migration from rural regions to urban regions was prohibited. Since the 1980s, the *Hukou* system has been deregulated, great differences in the labor market remain between rural and

urban areas. For example, the social security systems (i.e., public pension, medical insurance schemes) differ under the *Hukou* system. Therefore, a urban *Hukou* dummy variable is used to control the influence of segmentation, which is equal to 1 when a woman has urban *Hukou* and equal to 0 when the individual has rural *Hukou*. (3) A spouse dummy variable is conducted, which is equal to 1 when a woman has a husband and equal to 0 when she is single. (4) The culture and the economic development level may change for different periods; therefore, the year dummy variables (2011, 2013, 2015) are included in the control variables. Although previous studies (Wu et al. 2018; Lin 2019) reported that social capital may affect volunteer activity in China, because we cannot obtain the information from the CHARLS, this must be a future research issue. The gender gap of volunteer activity is discussed in the following section.

Table 6.1 presents descriptive statistics for (a) the total sample, (b) participation in a volunteer activity group (PVA), and (c) non-participation in a volunteer activity group (non-PVA) of individuals aged 45–69. It is observed that (1) in China, the proportion of participation in volunteer activity for individuals aged 45–69 is 15.8%. (2) To compare the employment rate between PVA group and non-PVA group, it is 7.6% points higher for the PVA group than for the non-PVA group. (3) The proportion of middle-and high-level education groups is higher for the PVA group than for the non-PVA group. (4) The income level is higher for the PVA group than for the non-PVA group. In addition, the proportion of income transferred to children is higher for the PVA group than for the non-PVA group, while the proportion of pension recipients is lower for the PVA group than for the non-PVA group. (5) The number of children is less for the PVA group than for the non-PVA group, but the proportions of both caring for grandchildren and for parents are higher for the PVA group than for the non-PVA group. (6) The proportion of women with poor health status is 7.0% points lower for the PVA group than for the non-PVA group, while the proportion of healthy women is higher for the PVA group. The results show that individual attributes, family structure, and income factors differ between the PVA group and the non-PVA group. These factors should be controlled in estimations.

6.4 Results

6.4.1 Gender Gap in Volunteer Activity Participation

Table 6.2 displays the results for determinants of volunteer activity participation. Five models are used. To compare the appropriateness of these models, first, the likelihood-ratio test of rho = 0 indicated that the random effects model is more appropriate than the probit regression model (Model 1). Second, the Cragg-Donald Wald test results are more than 10 for Model 2, Model 3, and Model 5 (121.41 for Model 2, 190.06 for Model 3, and 122.63 for Model 5), suggesting that the instrumental variables in these models are not weak IVs. The results of the Durbin-Wu-Hausman test suggest that

Table 6.1 Descriptive statistics of variables

	Total (a)		PVA (b)		Non-PVA (c)		D b-c
	Mean	S.D	Mean	S.D	Mean	S.D	
Volunteer activity participation	0.158	0.365					
Female	0.483	0.500	0.439	0.496	0.492	0.500	−0.053
Work	0.765	0.424	0.829	0.377	0.753	0.431	0.076
Education							
Low-education	0.860	0.347	0.796	0.403	0.872	0.335	−0.076
Middle-education	0.118	0.323	0.160	0.367	0.110	0.313	0.050
High-education	0.022	0.147	0.044	0.205	0.018	0.133	0.026
Consumption	8.907	0.911	9.139	0.925	8.864	0.902	0.275
Pensioner	0.285	0.452	0.267	0.443	0.289	0.453	−0.022
Transfer to children	0.379	0.485	0.507	0.500	0.355	0.479	0.152
Number of children	2.361	1.191	2.186	1.119	2.394	1.201	−0.208
Grandchildren care	0.402	0.490	0.412	0.492	0.401	0.490	0.011
Parent care	0.093	0.291	0.125	0.331	0.087	0.282	0.038
Age	56.186	6.852	54.689	6.667	56.467	6.850	−1.778
Health status							
Poor	0.206	0.404	0.147	0.355	0.217	0.412	−0.070
Fair	0.523	0.500	0.532	0.499	0.521	0.500	0.011
Good	0.148	0.355	0.162	0.369	0.145	0.352	0.017
Very good	0.111	0.314	0.138	0.345	0.106	0.307	0.032
Excellent	0.013	0.113	0.020	0.139	0.012	0.107	0.008
Urban	0.211	0.408	0.261	0.439	0.201	0.401	0.060
Having spouse	0.924	0.265	0.931	0.253	0.923	0.267	0.008
Survey year							
y2011	0.305	0.460	0.161	0.368	0.332	0.471	−0.171
y2013	0.340	0.474	0.364	0.481	0.335	0.472	0.029
y2015	0.355	0.479	0.475	0.499	0.333	0.471	0.142
Observations	28,463		4,491		23,972		

Source Calculated based on CHARLS2011-2015
Note PVA: participation in volunteer activity; Non-PVA: Non-participation in volunteer activity

the instrumental variables in both Model 2 and Model 5 are endogenous variables that should be addressed by instrumental variables methods. Based on these results, it can be considered that Model 5 is more appropriate than the other models. Based on the results from Model 5, the new findings are summarized as follows.

Table 6.2 Determinants of volunteer activity participation (total samples)

	(1) Probit		(2) IV(2SPS)		(3) IV(2SRI)		(4) Random-effects (RE)		(5) RE and IV(2SPS)	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Female	−0.024***	−5.60	−0.036***	−6.87	−0.003	−0.33	0.116***	3.75	−0.012	−0.26
Work	−0.012***	−9.66	−0.051**	−2.18	−0.043*	−1.69	0.279***	9.31	−0.208*	−1.70
Residual item					0.101***	4.17				
Education (Low-education)										
Middle-education	0.035***	5.10	0.036***	5.22	0.033***	4.85	0.163***	4.64	0.156	4.44
High-education	0.083***	5.47	0.095***	6.18	0.095***	6.09	0.366***	5.25	0.412***	5.83
Income	0.018***	7.05	0.014***	5.28	0.014***	5.42	0.086***	6.71	0.071***	5.35
Pensioner	0.027***	4.13	0.016***	2.35	0.018***	2.57	0.130***	3.99	0.082***	2.38
Transfer to children	0.048***	10.63	0.052***	11.30	0.052***	11.22	0.227***	10.15	0.245***	10.66
Number of children	−0.006***	−2.76	−0.005***	−2.60	−0.005**	−2.39	−0.029**	−2.73	−0.026**	−2.45
Grandchildren care	0.014***	3.13	0.011**	2.39	0.011***	2.57	0.072***	3.20	0.055**	2.41
Parent care	0.082***	10.08	0.086***	10.51	0.086***	10.46	0.345***	9.53	0.361***	9.89
Age (age45–49)										
Age50–59	−0.029***	−5.45	−0.035***	−6.27	−0.034***	−6.12	−0.133***	−4.76	−0.165***	−5.67
Age60–69	−0.068***	−9.48	−0.079***	−9.99	−0.079***	−9.91	−0.336***	−8.51	−0.410***	−9.33
Health status (Poor)										
Fair	0.024***	4.07	0.034***	5.33	0.033***	5.25	0.120***	4.00	0.168***	5.11
Good	0.036***	4.57	0.050***	5.79	0.048***	5.57	0.162***	4.25	0.219***	5.32
Vey good	0.043***	5.12	0.057***	6.18	0.056***	6.03	0.198***	4.89	0.257***	5.88
Excellent	0.074***	3.74	0.087***	4.27	0.088***	4.27	0.318***	3.62	0.383***	4.28

(continued)

Table 6.2 (continued)

	(1) Probit		(2) IV(2SPS)		(3) IV(2SRI)		(4) Random-effects (RE)		(5) RE and IV(2SPS)	
	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value	dy/dx	z-value
Having spouse	−0.017**	−2.01	−0.009	−1.08	−0.009	−1.04	−0.087**	−2.03	−0.051	−1.15
Urban	0.027***	4.34	−0.005	−0.61	−0.035***	−6.58	−0.108***	−4.68	−0.172***	−6.17
Survey year (y2011)										
y2013	0.091***	14.70	0.096***	15.26	0.094***	15.03	0.431***	14.77	0.446***	15.17
y2015	0.133***	20.09	0.135***	20.36	0.134***	20.18	0.612***	19.71	0.623***	20.00
Number of obs	28,463		28,463		28,463		28,463		28,463	
Number of groups							16,508		16,508	
Likelihood-ratio test of rho = 0							chibar2(01) = 150.25		chibar2(01) = 154.94	
Pseudo R2	0.063		0.045		0.064					
Prob > = chi2(chibar2)	0.000		0.000		0.000		0.000		0.000	
Cragg-Donald Wald F-test			121.41		190.06				122.63	
			(P = 0.000)		(P = 0.000)				(P = 0.000)	
Durbin-Wu-Hausman			10.106		1.295				18.674	
			(P = 0.002)		(P = 0.255)				(P = 0.004)	

Source Calculated based on CHARLS2011–2015

Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Probit regression models are used. 2SPS: two-stage predictor substitution instrument variable methods; 2SRI: two-stage residual inclusion instrument variable methods; RE: random effects model

(3) Total samples including women and men are used

First, based on the results of Model 1, it is shown that the probability of participating in volunteer activity is smaller for women than for men; however, when the heterogeneity problem and the other endogeneity problem are addressed simultaneously (Model 5), the coefficient of the female dummy variable is not statistically significant. This suggests that the influence of unobservable factors—such as individuals' preferences and social participation ability—is greater; when these factors are not considered, the results may reflect an estimation bias.

Second, for the other determinants of volunteer activity,

(1) The probability of participating in volunteer activity is 20.8% points lower for the working group than for the non-working group. A trade-off relationship between market work and social activity is indicated. The results are consistent with those of Atoda et al. (1999), Atoda and Fukushige (2000), Yamauchi (2001), Carlin (2001), Ono (2006), and Moriyama (2007).
(2) The probability of participating in volunteer activity is 42.2% points higher for the highly educated group than for the low-educational level group. These results are consistent with those of Vaillancourt (1994), Freeman (1997), and Ma and Ono (2013).
(3) The probabilities of participating in volunteer activity are higher for the high-income group, for the pensioner group, and for the group transferring their pension income to their children. This suggests that the higher the level of income or wealth, the higher the probability of participating in volunteer activity. It is confirmed that the probability of participating in volunteer activity is higher for the group with high unearned income than for the group with low unearned income. These results are consistent with those of Menchik and Weisbrod (1987), Vaillancourt (1994), and Ma and Ono (2013). The consumption model is supported for individuals aged 45–69 in China.
(4) The coefficient of the number of children is a negative value, both caring for grandchildren and parents are positive values, and they are all statistically significant. This indicates that a higher number of children decreases the probability of participating in volunteer activity, but the availability of family care increases the probability of participating in volunteer activity. The results for the number of children are consistent with those of Atoda et al. (1999), Atoda and Fukushige (2000), Yamauchi (2001), Ono (2006), Moriyama (2007), and Ma and Ono (2013). However, the results for family care (grandchildren care, parent care) are not consistent with those of Menchik and Weisbrod (1987), Morgan et al. (1977), and Vaillancourt (1994). The reason may be as follows. The analyzed objects in previous studies included younger generations with younger children who need more parental (particularly mothers') care, but the analyzed objects in this study are individuals aged 45–69. The time constraints of work and family care differ by generation—younger, middle-aged, or older—therefore, the influence of family care on volunteer activity participation may differ for

each age group. In addition, it may be that family caregivers have more altruistic values and motivation to provide more volunteer support to others than non-family caregivers do. Ma and Ono (2013) found that, in Japan, the probability of participating in the volunteer labor supply is higher for those with strong altruistic values.

(5) The probability of participating in volunteer activity for those aged 45–49 is 16.5% points, which is 41.0% points lower than for those aged 50–59 and 60–69. This suggests that age negatively affects the probability of participating in volunteer activity, indicating that the probability of participating in volunteer activity decreases with age.

(6) The probability of participating in volunteer activity is higher for those who are healthy than for those with poor health (16.8%, 21.9%, 25.7% and 38.3% points higher for fair, good, very good and excellent health groups). These results indicate that the probability of participating in volunteer activity is higher for the healthy group than for the group in poor health. These results are consistent with those of Atoda et al. (1999) and Ma and Ono (2013).

6.4.2 Gender Gap of Determinants of Volunteer Activity Participation

To compare differences in the mechanism of participation in volunteer activity by gender, we employ the estimations for groups of women and men. Estimations using the random effects (RE) model or random effects and IV method (RE_IV) by age and region are performed to address the heterogeneities of different groups. The results of the tests for weak instrumental variables and endogeneity, indicate that the RE model is appropriate for the female group, and the RE_IV model is appropriate for the male. The results by using these models are summarized in Table 6.3.

The results indicate that all six factors influence the probability of participating in volunteer activity for both women and men, but the influences of these factors differ by gender. Notably,

(1) Market work negatively affects the probability of participating in volunteer activity for women (−0.422), while work is not statistically significant for men. This suggests that the negative effect of work is greater for women than for men. The results can be explained as follows. Family responsibilities are greater for women than for men. For example, in general, housework hours are longer for women than for men, and the problem of work–family conflict may be more severe for women than for men; therefore, the negative effect of work on participation in social activity is greater for women than for men.

(2) Education positively affects volunteer activity participation for both women and men; the effect of education is greater for women than for men.

(3) Both income level and transfer of income to children positively affect participation in volunteer activity for both women and men.

Table 6.3 Determinants of volunteer activity participation by female and male groups

	(1) Female		(2) Male	
	RE		RE	
	dy/dx	z-value	dy/dx	z-value
Work	−0.422**	−2.19	0.118	0.69
Education (Low-education)				
Middle-education	0.161***	2.80	0.149***	3.35
High-education	0.554***	4.72	0.350***	3.93
Income	0.038*	1.93	0.102***	5.52
Pension	0.079*	1.63	0.062	1.24
Transfer to children	0.224***	6.63	0.269***	8.55
Number of children	−0.013	−0.86	−0.038**	−2.54
Grandchildren care	−0.011	−0.32	0.124***	3.84
Parent care	0.404***	7.49	0.329***	6.62
Age (age45–49)				
Age50–59	−0.136***	−3.08	−0.204***	−5.14
Age60–69	−0.421***	−6.39	−0.376***	−6.12
Health status (Poor)				
Fair	0.194***	4.13	0.149***	3.13
Good	0.163***	2.62	0.254***	4.47
Vey good	0.323***	4.95	0.210***	3.48
Excellent	0.396***	2.87	0.358***	3.01
Control variables	Yes		Yes	
Number of obs	13,761		14,702	
Number of groups	8,221		8,287	
Likelihood-ratio test of rho = 0	chibar2(01) = 43.15		chibar2(01) = 104.14	
Prob > = chi2(chibar2)	0.000		0.000	
Cragg-Donald Wald F-test	210.75		150.22	
	(P = 0.000)		(P = 0.000)	
Durbin-Wu-Hausman	0.385		0.106	
	(P = 0.535)		(P = 0.774)	

Source Calculated based on CHARLS2011–2015

Note (1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) The random effects probit regression model (RE) is used for female group, and the random effects probit regression and instrument variable methods (RE_IV) is used for male group

(3) Control variables include urban, having spouse and survey year dummy variables. The results of control variables are not expressed in this table

(4) Although the coefficient of the number of children is a negative value for men, it is not statistically significant for women. Parental caregiving positively affects participation in volunteer activity for both women and men. In addition, receiving a pension may increase the probability of participating in volunteer activity for men. This suggests that the influence of family factors on volunteering is greater for men than for women.
(5) The probability of participating in volunteer activity decreases with age for both women and men.
(6) Better health status positively affects volunteer activity participation for both women and men.

6.5 Conclusions

This study investigates the determinants of participation in volunteer activity of individuals aged 45–69 in China. It uses the longitudinal data of the China Health and Retirement Longitudinal Survey (CHARLS) from 2011 to 2015. The random effects (RE) model and instrumental variables (IV) methods are used to address the unobserved heterogeneity and other endogeneity problems. The main findings are as follows.

First, the probability of participating in volunteer activity is smaller for women than for men. However, when the endogeneity problem are addressed, the coefficient of the female dummy variable is not statistically significant. This suggests that the influence of unobservable factors—such as individuals' preferences and abilities—on the gender gap of participation in volunteer activity is greater.

Second, for the determinants of participating in volunteer activity, the results indicate that, in general, (1) market work may decrease the probability of participating in volunteer activity. (2) The probability of participating in volunteer activity is higher for the well-educated group than for the less-educated group. (3) The probability of volunteer activity participation is higher for the high-income group than for the low-income group. (4) A greater number of children decreases the probability of participating in volunteer activity, but family care increases the probability of participating in volunteer activity. (5) The probability of participating in volunteer activity decreases as age increases. (6) The probability of participating in volunteer activity is higher for the healthy group than for the group in poor health.

Third, the results indicate that the influence of determinant factors on participating in volunteer activity is different by gender. For example, the negative influence of work on participation in volunteer activity is greater for women than for men.

Two significant policy implications are indicated by these results. First, participation in labor market work negatively affects participation in volunteer activity. There is a trade-off relationship between working hours and leisure (volunteer activity), particularly for women. This may be because the responsibility of work at home (e.g., child care, parent care) is greater for women than for men.[10] Therefore, accommodating both work and leisure is more difficult for women; in other words, work–family conflicts may be greater for women than for men. The probability of participating in social activity decreases as working hours are lengthened, particularly for female workers. Work–life balance policies, including the policy to promote men's participation in housework and family, and the mandatory family care leave system may increase women's participation in social activity. Nevertheless, the introduction of flexible systems of managing working hours (e.g., part-time work, job sharing, flexible working hours systems, or revising excessive overtime work) is imperative.

Second, the results suggest that the higher the unearned income, the higher the probability of participating in volunteer activity. Income inequality may contribute to the gap in volunteer activity participation. A low income may decrease participation in social activity, which may decrease social capital and increase the risk of social alienation. How to support the low-income group's participation in social activity, thereby increasing their well-being, is an important issue for the government.

Finally, the limitations of this study should be clarified. This study uses panel data (CHARLS from 2011 to 2015) to provide an empirical analysis of the gender gap in volunteer activity participation for individuals aged 45–69. The survey target objects of the CHARLS are individual aged 45 and older; therefore, samples in this study do not include younger generations. Further research to compare younger generations with middle-aged and older generations should be considered in the future. Even more detailed analysis of factors on the volunteer demand side is needed for China.

Notes

1. According to Snyder and Omoto (2008), volunteer activity is defined as "freely chosen and deliberate helping activities that extend over time, are engaged in without expectation of reward or other compensation and often through formal organizations, and that are performed on behalf of causes or individuals who desire assistance."
2. For detailed descriptions of the theories of volunteering, please refer to Haski-Leventhal (2009), Hustinx et al. (2010), and Snyder and Omoto (2008).
3. For literature review of empirical studies of volunteering, please refer to Smith (1994), Bekkers and Wiepking (2010), and Wilson (2012).

4. Please refer to Ma and Ono (2013) for a more detailed overview of the empirical research on volunteer activity.
5. Menchik and Weisbrod (1987) conducted a Tobit analysis of determining factors of volunteer activity hours, using data from a survey conducted by Morgan et al. (1977). Vaillancourt (1994) employed a probit regression analysis of determining factors of the probability of participating in volunteer activity, using survey data from Canada's 1987 Labor Force Survey (LFS).
6. In an analysis focusing on married women, Carlin (2001) used data from a 1975–1976 US survey on non-work time to conduct a probit regression analysis of the probability of participating in volunteer activity. Carlin estimated the volunteer activity time function, considering the selection bias based on the choice of whether to participate in volunteer activity.
7. The 2SRI model was advocated first by Hausman (1978), and then it was used by Blundell and Smith (1989). Newey (1987), Rivers and Vuong (1988), Newey and McFadden (1994), and Terza et al. (2005, 2008) pointed out that the SRI model can be used in binary variable analyses and can be considered to be an expansion of the 2SLS model for binary variable analyses.
8. To check for robustness, the only information used to define volunteer activity is the individual's responses to "Done voluntary or charity work"; results using this narrow definition of volunteer activity are similar to those using the broad definition in this study.
9. The low-education category includes those with no formal education, those who did not finish primary school, those who were homeschooled, and those completing elementary school; the middle-education category includes those who completed junior high school, senior high school, and vocational school; the highly educated category includes those who attended college, university, or graduate school.
10. For the gender gap in home responsibilities, such as child care and parent care, please refer to Chaps. 2 and 3 of this book.

Appendix

See Table 6.4.

Table 6.4 Probability of work (first-stage estimation in the IV methods)

	(1) Probit		(2) Random effects probit	
	dy/dx	z-value	dy/dx	z-value
Formal retirement	−0.293***	−26.37	−1.351***	−22.55
Female	−0.148***	−28.53	−0.880***	−23.17
Education (Low-education)				
Middle-education	0.003	0.33	−0.004	−0.08
High-education	0.058***	3.57	0.330***	2.77
Age (age45–49)				
Age50–59	−0.076***	−9.98	−0.433***	−9.56
Age60–69	−0.187***	−19.38	−0.993***	−17.57
Having spouse	0.090***	9.34	0.477***	8.37
Health status (Poor)				
Poor	0.122***	19.71	0.618***	16.75
Fair	0.119***	16.47	0.769***	14.97
Good	0.119***	15.20	0.780***	13.63
Excellent	0.121***	6.48	0.846***	6.06
Urban	−0.187***	−22.36	−0.947***	−19.08
Grandchildren care	−0.032***	−6.12	−0.151***	−4.86
Parent care	0.044***	4.80	0.223***	4.08
Number of children	−0.001	−0.54	−0.009	−0.6
Transfer to children	0.058***	10.81	0.274***	8.83
Income	−0.027***	−8.96	−0.121***	−6.92
Pensioner	−0.021***	−2.88	−0.152***	−3.84
Survey year (y2011)				
y2013	0.020***	3.11	0.110***	3.23
y2015	0.013*	1.93	0.027	0.74
Number of obs	28,463		28,463	
Number of groups			16,508	
Likelihood-ratio test of rho = 0			chibar2(01) = 1512.84	
Pseudo R2	0.200			
Prob > = chi2	0.000		0.000	

Source Calculated based on CHARLS2011-2015.
Note ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

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Part III
Impact of Policy on Women's Labour Market Outcomes in China

Chapter 7
The Impact of Higher Education Expansion Policy on the Wages of Female and Male College Graduates

Abstract Based on the quasi-natural experiment methods (DID method and DDD method), using six waves longitudinal survey data of the China Health and Nutrition Survey, this study investigates the influence of the Higher Education Expansion Policy (HEEP) on the wage levels of young college graduates and compare the different policy influences by gender. The results indicate that the HEEP does not affect the wage levels of young college graduates significantly; the HEEP decreased the wage level of new college graduates in the short term, whereas the negative effect disappears in the long term for both female and male younger workers; the gender differences in the impacts of the policy on the wage levels of new college graduates are smaller.

Keywords Higher education expansion policy · College graduates · Gender · Wage · China

7.1 Introduction

China's planned economic system was reformed after 1978. A set of new policies were implemented by the Chinese government, and China experienced great economic growth which achieved an average GDP growth rate of around 10% during the 1990s and 2000s. In 1999, the Higher Education Expansion Policy (HEEP) was implemented by the government. Along with the policy implementation, the number of college graduates increased from 1.08 million in 1998 to 6.381 million in 2013 (NBS 2016).[1] According to the general market equilibrium mechanism, when labor demand is consistent, an increase of the college graduate labor supply in the short term may decrease the graduate wage level (negative effect); whereas the increase of college graduate workers may promote technological innovation and increase economic growth. When the labor demand for college graduates increases greatly with economic growth or technological progress, the college graduate wage level

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may increase even after the implementation of the HEEP (positive effect). Thus, the influence of the policy is not clear and it deserves empirical investigation.

This study employs a quasi-experiment method based on the DID method (Difference in difference method) and DDD method (triple differences method) to estimate the impact of the HEEP on college graduates' wages in China, and compare of the differences of impacts by female and male groups. It uses data from a longitudinal survey data from the Chinese Health and Nutrition Survey (CHNS) conducted from 1997 to 2011. These analyses build on the findings of relevant published research.

This chapter is structured as follows: Sect. 7.2 introduces the implementation of higher education expansion policy, Sect. 7.3 introduces the channels by which the HEEP y can affect college graduates wage, and introduces previous empirical studies on the issue. Section 7.4 gives the framework of the empirical analysis, including models and datasets. Section 7.5 presents estimated results and explains these results. Section 7.6 summarizes the conclusions.

7.2 Hight Education Expansion Policy in China During the Economic Transition Period

The Chinese government promoted the enrollment of compulsory education and higher education since the planned economy period of the 1950s. This study focuses on the HEEP during the market-oriented economy period (transition period) as follows.

In 1999, the State Council approved the *Plan of Revitalizing Education in the Twenty-First Century* proposed by the Ministry of Education to expand higher education enrollment. The plan included various strategies to encourage universities to set up multiple campuses as well as instituting the private colleges. The plan called for an increase in public education expenditures, especially in tertiary education. The proposal aimed at an increase in the gross enrolment ratio in tertiary education, a rise in the student-teacher ratio, and an increase in state educational funding. A target was set in the plan for China to reach a tertiary enrollment ratio of 15% by 2010, defined as "mass higher education" (Trow 1972, 1973). In addition, in 2004, the Chinese State Council passed *A Plan of Education Revitalization 2003–2007*. This plan focused on the improvement of teaching, mainly for universities on the "985" and "211" lists. It emphasized the reform of the teaching and evaluation system, and the implementation of the *Improvement of New Graduates Employment Program* policy. It required the higher education system to prepare new graduates for the jobs market. In 2010, the *National Outline for Medium and Long-term Reform and Development (2010–2020)* was published. This plan sought to improve teaching, scientific research, and the social relevance of education, and to let the total number of enrolled college student increase to 33 million by 2020: this indicates that higher education expansion will continue.

China's higher education developed rapidly with the implementation of these polices (see Fig. 7.1). From 2000 to 2011 the enrollment of regular college[2] students expanded from 5.56 to 26.25 million, and annual college graduate students increased from 0.95 to 6.81 million. From 2000 to 2015 enrollment of senior high school students expanded from 12.01 to 23.74 million, and annual college graduate students increased from 30.15 to 79.77 million. It is observed that with the implementation of the HEEP, both the students and graduates of college and senior high school increase

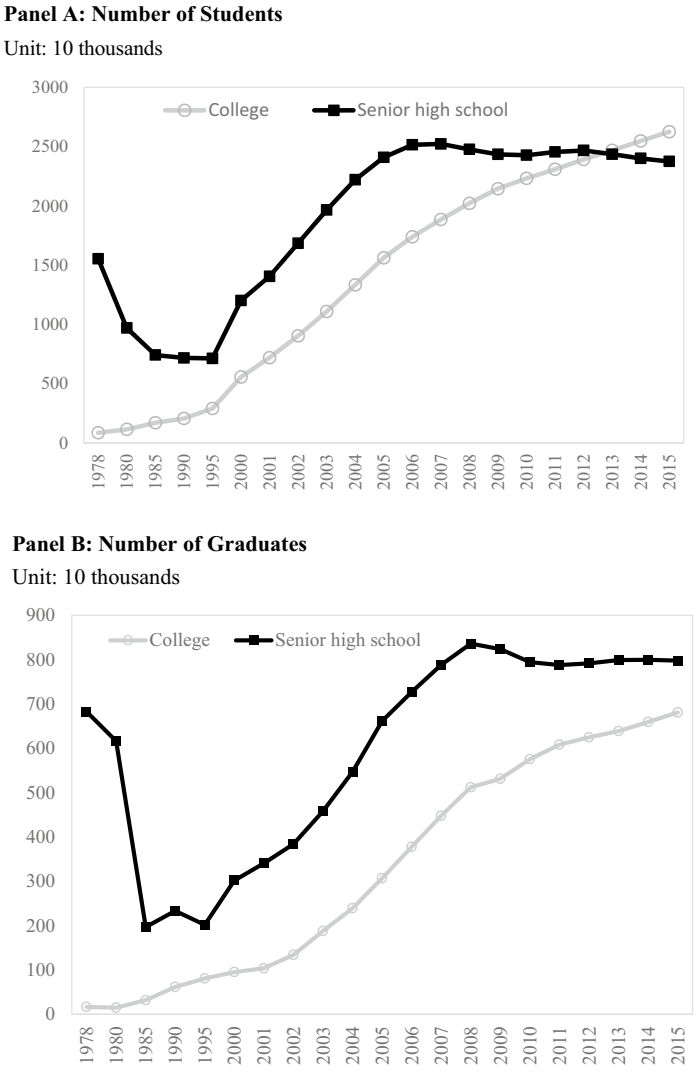

Fig. 7.1 Numbers of students in schools and graduates from 1990 to 2015. *Source* Based on data from *China Statistics Yearbook 2016*

greatly. It is thought that the increase in the higher education labor supply affects the employment of young graduates.

7.3 Literature Review

7.3.1 The Channels of the Impact of Higher Education Expansion Policy on the Wages of College Graduates

How does the HEEP affect the wage level of new college graduates? Based on economic theories, both positive and negative effects can be considered as follows.

First, based on the general market equilibrium mechanism, when the labor demand is constant, the increase of new college graduates supply in the short term may decrease the college graduate wage level (negative effect). Whereas, when economic growth is strong or technological innovation is progressing, the increase of demand for higher education and highly-skilled workers is greater than the supply, the wage level for college graduates may not change or may even increase during policy implementation (positive effect).

Second, according to human capital theory (Becker 1964; Mincer 1974), when the increase in productivity of a higher education worker is greater than that for workers with a low- and middle-education levels, the wage level which is set by the firm may be more for the worker with a higher education than for low- and middle- education worker (positive effect).

Third, according to signal theory (Spence 1976), the education level can be used as a sign by which the firm can identify the ability of an employee. In the absence of a better way for the firm to identify an employee's actual ability, the firm may evaluate and judge the worker' ability based on the employee's educational attainment. When the firm believes the college graduates are the most productive employees than the counterparts, the wage level may be higher for college graduates (positive effect). However, when the number of college graduates increases, the signal function may lead the firm to recruit college graduates to substitute the high school graduates and recruit graduates with second or postgraduate degrees to fill jobs formerly given to college graduates: this may cause the wage of the college graduates decreased (negative effect).

Based on these theories and hypotheses the influence of the higher education expansion policy on the wage of college graduates is not clear. Therefore, an empirical study is needed.

7.3.2 Previous Empirical Studies on the Issue

For the empirical study results on the impact of the HEEP on the labor market, we summarize its impact on wage as follows.[3]

He (2009) used Chinese Health and Nutrition Survey (CHNS) data to estimate the education return from 1991 to 2006 based on the OLS, and shows that the education effects on wage (education return) decreased from 2004 to 2006. He points out that the higher education expansion policy may affect the wage level of higher education graduates. Chang and Xiang (2013) analyzed the change of education return from 1989 to 2009 using CHNS data. Based on a Heckman two step model, they estimate the education return for the pre-policy period (1989–1993, 1997, 2000) and post-policy period (2004, 2006, 2009) groups, and the group aged 19–26 and the group aged 27–55. They found that compared to the pre-policy period, the wage gap between college and senior high school graduates increased during the post-policy period. It seems that the policy positively affects the wage level of college graduates. Using data from the China Urban Labor Survey (UCLS) in 2001, 2005, and 2010, Gao and Smyth (2015) estimated the education return based on OLS and instrument variables methods, they indicate that the education return increased from 2001 to 2005 and 2010. Xia et al. (2016) employed CHNS data from 2000 to 2009 to estimate education return based on the quantile regression model and Firpo, Fortin, and Lemieux (FFL) decomposition method. They find the education return increased from 2000 to 2009 and the education return is higher for the high-wage group than the middle and low wage groups. It should be noticed that these previous empirical studies did not consider the unobserved heterogeneity problem among various groups. Wu and Zhao (2010) addressed this and estimate the impact of the HEEP on wage directly based on a DID method and DDD method using data from the China Urban Labor Survey (CULS) for 2002 and Chinese 1% Population Census data. It is found that the policy decreases the wage level based on the DID method whereas the impact of the policy on wages are not statistically significant based on DDD method Yao et al. (2014) also estimated the policy influence based on DID and DDD methods using China Urban Household Income Survey data from 1998 to 2005. They find that the higher education expansion policy negatively affects the wage of young college graduates, but the negative effect decreases in the long term. Wu and Zhao (2010), and Yao et al. (2014) used the same DID and DDD methods to find a different outcome for the impact of policy on wage. This suggests that more research is needed on this topic.

7.3.3 Contributions of This Study

Although the previous empirical studies investigate the impact of higher education expansion on the wages of college graduates, the empirical studies based on an experiment analysis method are scarce. There remain further areas to be researched. The main contributions of this current study can be summarized as follows.

First, the impact of policy may vary according to period. For example, in a perfect competition market, in a short-term, the dramatic increase of college graduate labor supply may affect wage level of new college graduates. Whereas in a long-term, the influence of the policy may decrease because the labor demand for college graduates may increase with economic growth or industrial structure upgrading. Yet there is no empirical study based on DID and DDD methods which scrutinizes the short term and long-term effects. This study tries to address this need.

Second, because there remains the gender wage gap in China (Gustafsson and Li 2000; Li and Ma 2006, 2015; Ma et al. 2013; Ma 2018a, b), to consider the gender disparities of the family responsibility, labor participation behavior and work efforts, this study also compares the policy influence by gender.

Third, as the one of features of Chinese economy, the Chinese labor market is segmented by various sectors and regions. For example, due to the large regional disparity in China, the impact of the policy may differ by regions. This study also analyzes the effect of the policy in the Eastern, Central, and Western Regions. In additions, there remains the discrimination against migrants by the *Hukou* system (Meng and Zhang 2001; Song and Appleton 2006; Ma 2018c), we also investigate the policy effects by the rural *Hukou* and urban *Hukou* resident groups.

Fourth, a set of robustness checks is employed to test the analysis appropriateness. These results may develop previous studies on the issue.

7.4 Methodology and Data

7.4.1 Model

The DID method is used to investigate the impact of higher education expansion policy on wages:

$$Y_{it} = a + \beta_1 Year_t + \beta_2 Treat_{it} + \beta_3 Treat_{it} * Year_t + \beta_4 X_{it} + \varepsilon_{it} \quad (7.1)$$

The object analyzed by the DID method is the college graduates aged 21–40. In Eq. (7.1), Y is hourly wage logarithms, i stands the individual, t is years, $Year$ is post-policy period (2004, 2006, 2009, and 2011 in this study), $Treat$ is the treatment group, X includes the individual characteristics variables (e.g. family numbers, health status, and gender), *Hukou*, and the regional characteristics variables. a is the constant term, and ε is the error term. β_1–β_4 represent the estimated coefficient for each variable. This study uses the survey years before the implementation of the higher education expansion policy (1997, and 2000) as the pre-policy period and the years of 2004, 2006, 2009, and 2011 as the post-policy period. In this study the treatment group is defined as college graduates aged 21–25 and the control group is defined as college graduates aged 31–40.

The DDD method is shown by Eq. (7.2). The object analyzed by the DDD method includes both college and senior high school graduates aged 21–40.

$$Y_{it} = a + \beta_1 Year_t + \beta_2 age_{21-25it} + \beta_3 Colle_{it} + \beta_4 age_{i21-25t} * Colle_{it} * Year_t + \beta_5 X'_{it} + \beta_\lambda \lambda_{it} + \varepsilon_{it} \tag{7.2}$$

In Eq. (7.2), age_{21-25} is the group aged 21–25, $Colle$ is the college graduate group, X' includes the individual characteristics variables, the regional characteristics variables and other variables including the interaction item of age and year dummy variable, the interaction item of college graduate and year dummy variable, and the interaction item of college graduate and age dummy variable.

In the Eqs. (7.1) and (7.2), β_3 and β_4 represents the estimated coefficient of DID or DDD items. When β_3 and β_4 is a negative value, and it is statistically significant, it indicates that the implementation of the higher education expansion policy reduces the wage level of young college graduate, and vice versa.

A sample selection bias problem may exist therefore a DID method or DDD method based on the Heckman two-step model is also used to correct the bias (Heckman 1979). In Eqs. (7.1) and (7.2), the inverse Mills' ratio λ is an adjusted item. λ is calculated by $\lambda = \phi(\gamma_t Z_{it})/\Phi(\gamma_t Z_{it})$, $\phi(\cdot)$, $\Phi(\cdot)$ is a normal density function and distribution function based on the probit regression model, Z is factors which affect the employment status selection (e.g. to work or not to work), γ represents the coefficients of these factors.

7.4.2 Data

This study employs six waves (1997, 2000, 2004, 2006, 2009, and 2011) longitudinal data from the Chinese Health and Nutrition Survey (CHNS) conducted from 1997 to 2011. CHNS is a nationwide longitudinal survey conducted by the Carolina Population Center at the University of North Carolina and the National Institute for Nutrition and Health (NINH, former National Institute of Nutrition and Food Safety) at the Chinese Center for Disease Control and Prevention. The survey took place over seven days using a multistage, random cluster process to draw a sample of about 7,200 households with over 30,000 individuals in fifteen provinces and municipal cities that vary substantially in geography, economic development, public resources, and health indicators. Although the longitudinal survey began in 1989 this study uses the survey data from 1997 to 2011 because the higher education expansion policy was implemented in 1999. This study uses samples from 11 provinces and municipalities: Beijing, Liaoning, Heilongjiang, Shanghai, Jiangsu, Shandong, Hernan, Hubei, Hunan, Guangxi, and Guizhou.

The independent variable is the logarithms value of hourly wage. The wage is the earning income including the basic wage and the allowance, and not including the bonuses. The nominal wage is adjusted to the real wage by the 2011 CPI (Consumption Price Index).

Figure 7.2 shows both the monthly wage and hourly wage from 1989 to 2011. Because the higher education expansion policy was implemented in 1999, the effect of the policy on wage appears in the period after 2002 for college graduates whose degree takes for three years and 2003 for college graduates whose degree takes for more than four years. Thus the period from 1989 to 2000 is the pre-policy period and the survey period from 2004 to 2011 is the post-policy period. The monthly wage and hourly wage are calculated for three groups: college graduates aged 21–25; college graduates aged 31–40, and senior high school graduates aged 21–25. The change

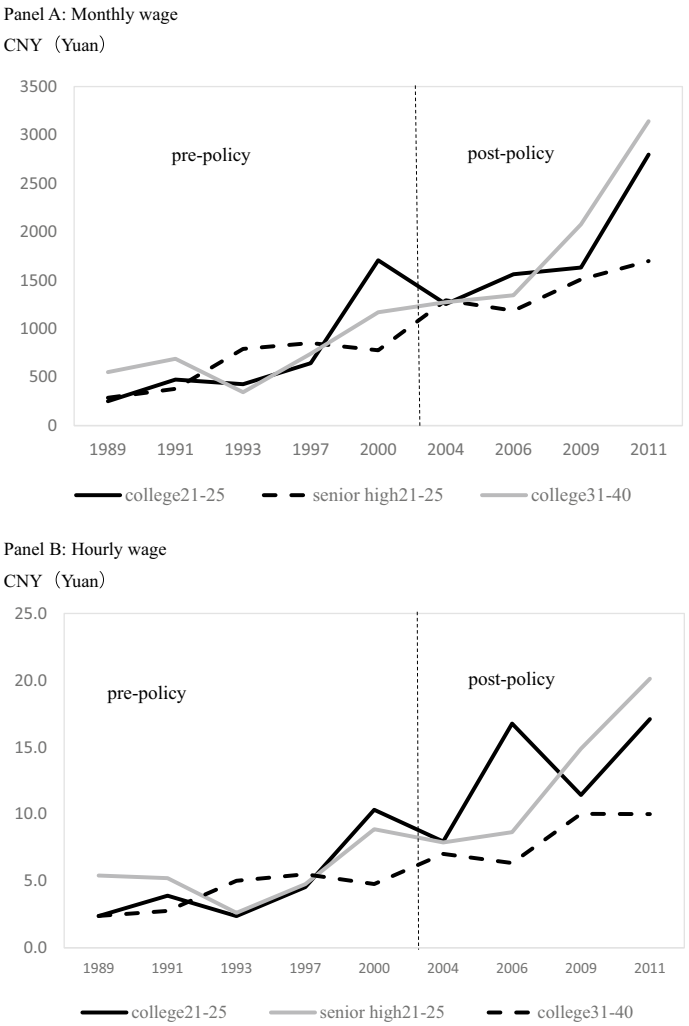

Fig. 7.2 Wage by age and education groups from 1989 to 2011. *Source* Calculated based on CHNS 1989–2011

tendency of wages from 1989 to 2011 is similar for Panel A (monthly wage) and Panel B (hourly wage). It is observed that as the wage increased from 1989 to 2011, the wage gaps between the three groups are different. It indicates that the work hours may be different between the three groups. To consider the influence of work hours, the hourly wages are used in the study. The main results of Panel B (hourly wage) in Fig. 7.2 are as follows.

First, when compare the college graduates aged 21–25 with the college graduates aged 31–40, it is observed that except in 1993 and 1997, the wage is higher for the college graduates aged 21–25 than for the college graduates aged 31–40 during both pre-policy period and post-policy period. However, for college graduates aged 21–25, the wage decrease is greater for 2004 and 2009. It is indicated that the higher education expansion policy seems likely to reduce the wage gaps in both 2004 and 2009. Excepting the period of world financial crisis in 2007, the higher education expansion policy seems to affect the wage of young college graduates in a short term.

Second, to compare the college graduates aged 21–25 with the senior high school graduates aged 21–25, even though the wage gaps between these two groups are different by periods, the relations between these two groups are not observed clearly. For example, during the pre-policy period, the wage is higher for senior high school graduates aged from 21 to 25 than the counterpart, whereas the wage is higher for college graduates aged 21–25. Moreover, during the post-policy period, the wage is higher for college graduates aged 21–25 in 2006 and it is lower in 2009 and 2011 than for the counterpart.

7.4.3 Variable Setting

The main dependent variables are constructed as follows (see Appendix Table 7.11). First, *Year* is a set of year dummy variables. In the study, 1997, 2000 is the pre-policy period, and 2004, 2006, 2009, and 2011 is the post-policy period. *DID* in the Eq. (7.1) is the interaction term of the two variables used: the post-policy period and treatment group dummy variables. The treatment group is defined as the college graduates aged 21–25. *DDD* in Eq. (7.2) is the interaction term of the three variables used: the post-policy period dummy, the group aged 21–25 years old dummy, and the college graduate dummy variables ($Year * Age_{21\text{-}25} * Colle$).

Second, for the other factors, (1) the years of experience and health status are used as human capital. (2) The male dummy is used to control the gender gap in labor market. (3) To control the influence of occupation on wage, the occupation dummy variables (manager, technician, clerk, agriculture job, high-level manufacturing job, low-level manufacturing job, service job, the other job) are constructed. (4) To consider the labor market segmentation by various groups and regions, the private sector dummy, the urban areas, and region blocks (Eastern, Central, Western) dummy variables are constructed.

Third, the first-step in the Heckman two-step model is a work probability function (e.g. work or not to work). The factors that affect labor participation behavior are also constructed. They are the individual variables including age, number of

family members, gender, health status, urban hukou, and the province level variables including regional ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita.[4]

It is thought that the results may be sensitive by the treatment group setting. In this study, the rule to distinguish the treatment group and control group is based on age categories. To compare the impact of the higher education expansion policy on wage by various age category groups, an analysis by the following function is used:

$$Y_{it} = a + \beta_1 year_i + \beta_2 age_{it} + \beta_{3a} \sum_{a=21}^{30} age_{it} * year_t + \beta_4 X_{it} + \varepsilon_{it} \quad (7.3.1)$$

$$Y_{it} = a + \beta_1 year_i + \beta_2 age_{it} + \beta_3 Colle_{it} + \beta_{3a} \sum_{a=21}^{30} age_{it} * year_t * Colle_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (7.3.2)$$

In Eqs. (7.3.1) and (7.3.2), i stands for the individual, t for years, $year$ for policy implementation years (2004, 2006, 2009, and 2011 in this study), age for the age dummy, X for the individual characteristics variables (e.g. family numbers, health status, gender), the regional characteristics variables and other variables. In the Eq. (7.3.2), X also includes the interaction item of age and year dummy variable, the interaction item of college graduate and year dummy variable, and the interaction item of college graduate and age dummy variable. a is the constant term, and ε is the error term. β represents the estimated coefficient for each variable. The results of β_{3a} are summarized in Table 7.1.

The results indicate that although all coefficients are not statistically significant, the higher education expansion policy negatively influences the wage of college graduates aged 21–25; whereas it almost positively affects the wage of the university graduates aged 26–30. It is observed that the influences of the policy are different between the group aged 21–25 and the group aged 26–30. The results of estimation 2 showed a similar tendency, the influence of the policy is negative for the treatment group (group aged 21–25), whereas they are almost positive for the other group. It is confirmed that to define the treatment group as college graduates aged 21–25 is appropriate. However, the impacts of the policy on the college graduate group aged 26–30 are various, it indicates that the estimated results may differ by the treatment group setting. The results of a set of robustness checks for age groups will be discussed in Sect. 7.5.

Table 7.1 Test results for treatment group setting

	Model 1: DID		Model 2: DDD	
	coef.	S.E.	coef.	S.E.
Age 21	−0.065	0.265	−0.079	0.399
Age 22	−0.116	0.194	−0.259	0.305
Age 23	−0.110	0.206	−0.237	0.324
Age 24	0.123	0.164	0.272	0.259
Age 25	−0.079	0.106	−0.031	0.233
Age 26	−0.015	0.125	0.610**	0.271
Age 27	0.033	0.098	0.115	0.235
Age 28	0.220**	0.095	0.106	0.238
Age 29	0.033	0.087	0.274	0.227
Age 30	0.058	0.084	0.151	0.220

Source Calculated based on CHNS 1989–2011
Note
(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) The treatment group, age, year, male, health status, occupation, private sector, regular worker, urban hukou, province dummy variables are estimated, these results are not expressed in this table. The DID item and DDD item coefficients are only shown in this table

7.5 Results

7.5.1 The Impact of Higher Education Expansion Policy on the Wage of College Graduates

The calculated results based on DID method are shown in Table 7.2. The treatment group is college graduates aged 21–25, the control group is college graduates aged 31–40. 2000 is the pre-period of policy implementation, and 2004, 2006, 2009, 2011 are the post-periods. The values of coefficients of DID items are from −0.109 to −3.447, it is shown that the HEEP decreased the average wage level of young college graduate from 2004 to 2011. In addition, to compare with 2004 (−0.114) and 2006 (−0.109), the negative values are greater for 2009 (−3.447) and 2011 (−3.385). It indicates that the policy influences differ by the short term and the long term after the policy implementation.

The calculated results based on a DID method shown in Table 7.2 did not consider the other factors which may affect wage. When the other factors are controlled, does the higher education expansion policy affect the wage level of college graduates? Tables 7.3, 7.4 and 7.5 summarizes the econometric analysis results. Panel A is the results based on DID method, and Panel B is the results based on DDD method. The main findings are as follow:

First, based on the results shown in Table 7.3, the coefficients of DDD item are not statistically significant in both Panel A and Panel B. It indicates that, generally, the

Table 7.2 Calculated result based on the DID method

Panel A			
	a:2000	b:2004	D(b-a)
T: Treatment group	8.685	7.584	−1.101
	(10.000)	(4.640)	
C: Control group	8.865	7.878	−0.987
	(9.675)	(5.648)	
D(T-C)	−0.180	−0.294	−0.114
Panel B			
	a:2000	b:2006	D(b-a)
T: Treatment group	8.685	8.360	−0.325
	(10.000)	(5.256)	
C: Control group	8.865	8.649	−0.216
	(9.675)	(11.857)	
D(T-C)	−0.180	−0.289	−0.109
Panel C			
	a:2000	b:2009	D(b-a)
T: Treatment group	8.685	11.258	2.573
	(10.000)	(7.168)	
C: Control group	8.865	14.885	6.020
	(9.675)	(28.312)	
D(T-C)	−0.180	−3.627	−3.447

Source Calculated based on CHNS 1989–2011
Note
(1) Values in parentheses are standard deviation
(2) Treatment group is the college graduates aged 21–25; Control group is the college graduates aged 31–40

higher education expansion policy does not affect the average wage level of young college graduates.

The results based on the quantile regression model are shown in Table 7.4. For both low-wage (10th), middle-wage (30th, 60th) and high-wage (90th) groups, the coefficients of DID item are not statistically significant. It suggests that the difference of policy effect between various wage centile groups is small.

Finally, to compare the influence of the HEEP on wage by different periods (e.g. a short term, or a long term after the policy implementation), the year dummy variable is used and the results are summarized in Table 7.5. The results based on DID method indicates that the higher education expansion policy negatively affected wages in 2004, whereas the coefficients of DID items are not statistically significant for 2006, 2009 and 2011. It indicates that the HEEP may decrease the wage level of new college graduates in the short term, whereas the negative effect disappears in the long term. The reason for the results can be considered as follows. First, in the short term,

Table 7.3 Results of the impact of the higher education expansion policy on the wage of college graduates

Panel A: DID method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.146	0.455	0.386	0.445	0.096	0.203
Year	0.683***	0.243	0.757***	0.219	0.586***	0.098
DID	−0.277	0.480	−0.397	0.462	−0.095	0.209
Exp.	−0.113	0.078	−0.109	0.069	−0.043	0.031
Exp-sq.	0.008	0.007	0.008	0.006	0.004	0.003
Health			−0.006	0.028	−0.007	0.013
Male			0.087	0.163	0.121*	0.070
Occupation (Clerk)						
Manager			0.220	0.188	0.302***	0.080
Technician			−0.022	0.255	0.017	0.106
Agriculture			−0.119	1.013	−0.044	0.682
Manufacturing job (H)			−0.240	0.369	−0.156	0.155
Manufacturing job (L)			−0.473	0.616	−0.071	0.285
Service			0.033	0.359	0.076	0.153
Others			0.033	0.277	0.034	0.127
Regular worker					0.022	0.079
Private sector					−0.034	0.143
Urban					0.276***	0.076
Region (East)						
Central					−0.338***	0.103
West					−0.289**	0.129
Constants	2.205	0.342	2.0124	0.378	1.792***	0.195
Inverse Mills ratio	−2.833	1.177	−2.502	0.981	−1.030**	0.518
Observations	980		980		980	
Prob > chi2	0.0321		0.056		0.000	
Panel B: DDD method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.038	0.407	0.140	0.430	−0.006	0.404
Year	0.234	0.215	0.277	0.215	0.005	0.209
College	0.503	0.344	0.338	0.340	0.228	0.302
Year * College	0.079	0.379	0.076	0.370	0.138	0.325
Year * Aged 21–25	0.113	0.489	0.128	0.524	0.234	0.475

(continued)

Table 7.3 (continued)

Panel B: DDD method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
College * Aged 21–25	−0.116	0.875	0.063	0.910	−0.011	0.846
DDD	−0.146	1.015	−0.345	1.061	−0.200	0.963
Exp.	0.019	0.059	0.010	0.058	0.019	0.052
Exp-sq.	−0.000	0.005	0.000	0.005	0.000	0.004
Health			−0.009	0.029	−0.018	0.026
Male			−0.104	0.159	−0.112	0.142
Occupation (Clerk)						
Manager			0.207	0.211	0.209	0.179
Technician			0.125	0.284	0.120	0.241
Agriculture			0.0111	0.436	0.037	0.471
Manufacturing job (H)			−0.133	0.260	−0.127	0.227
Manufacturing job (L)			−0.260	0.275	−0.218	0.249
Service			−0.036	0.261	−0.062	0.230
Others			−0.007	0.247	0.084	0.248
Regular worker					0.021	0.142
Private sector					−0.013	0.272
Urban					−0.125	0.155
Region (East)						
Central					−0.171	0.160
West					0.048	0.224
Constants	2.128***	0.342	2.324***	0.453	2.746***	0.455
Inverse Mills ratio	−5.347***	1.526	−5.090***	1.385	−4.213***	1.088
Observations	4,064		4,064		4,064	
Prob > chi2	0.151		0.547		0.778	

Source Calculated based on CHNS 1989–2011

Note

(1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table

(3) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table

Table 7.4 Results of the impact of the higher education expansion policy on the wage of college graduates by wage centiles

	10th	30th	60th	90th
Treatment	0.255	0.254	0.102	−0.100
	(0.548)	(0.207)	(0.180)	(0.341)
Year	0.948***	0.720**	0.630***	0.445***
	(0.241)	(0.091)	(0.079)	(0.150)
DID	−0.097	−0.028	−0.0226	−0.084
	(0.581)	(0.220)	(0.191)	(0.362)
Inverse Mills ratio	−3.009*	−2.779***	−3.005***	−2.617***
	(1.658)	(0.627)	(0.545)	(1.032)
Constants	0.627	1.209***	1.859***	2.825***
	(0.425)	(0.161)	(0.140)	(0.265)
Observations	980	980	980	980
Pseudo R2	0.112	0.146	0.1407	0.14

Source Calculated based on CHNS 1989–2011
Note
(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) The coefficients, standard error and statistical significances are summarized in this table
(3) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table
(4) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table
(5) The quantile regression model is used

here 2004, the great increase of college graduates from 0.95 million in 2000 to 2.39 million in 2004 became a great shock of labor supply of higher education workers, which may reduce the probability of labor participation for young college graduates and decrease the higher education graduate group's wage level. Second, in a long term, with economic growth and technological progress, labor supply and demand can be adjusted by the general equilibrium mechanism, and the negative effect of the policy may become smaller or disappear.

Table 7.5 Results of period effect of the impact of higher education expansion policy on the wage of college graduates

Panel A: DID method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.145	0.436	0.376	0.417	0.076	0.180
Year	0.690***	0.233	0.766***	0.205	0.607***	0.085
DIDy2004	−0.585	0.620	−0.777	0.574	−0.550**	0.244
DIDy2006	−0.388	0.586	−0.576	0.559	−0.279	0.235
DIDy2009	−0.287	0.598	−0.318	0.576	0.008	0.240
DIDy2011	−0.085	0.523	−0.180	0.493	0.151	0.209
Constants	2.180***	0.329	1.985***	0.357	1.700***	0.171
Inverse Mills ratio	−2.714**	1.139	−2.341**	0.937	−0.760*	0.456
Observations	980		980		980	
Prob > chi2	0.082		0.000		0.000	
Panel B: DDD method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.035	0.251	0.0992	0.259	−0.057	0.221
College	0.467	0.212	0.308	0.205	0.184	0.166
y2004	0.209	0.158	0.243	0.154	−0.001	0.129
y2006	0.094	0.160	0.133	0.156	−0.012	0.138
y2009	0.380***	0.175	0.447***	0.173	0.252	0.159
y2011	0.656***	0.187	0.720***	0.186	0.436**	0.188
Year * College	0.025	0.234	0.015	0.223	0.114	0.178
College * Aged 21–25	−0.033	0.540	0.134	0.548	0.067	0.463
Year * Aged 21–25	0.099	0.302	0.107	0.315	0.233	0.260
DDDy2004	−0.149	0.813	−0.334	0.816	−0.257	0.663
DDDy2006	0.088	0.784	−0.150	0.810	−0.083	0.647
DDDy2009	−0.117	0.799	−0.173	0.831	−0.133	0.659
DDDy2011	−0.220	0.696	−0.360	0.704	−0.227	0.571
Constants	1.769***	0.240	1.876***	0.307	2.131***	0.326
Inverse Mills ratio	−3.296***	1.137	−3.060***	1.029	−2.302***	0.872
Observations	4,046		4,046		4,046	

(continued)

Table 7.5 (continued)

Panel B: DDD method						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Prob > chi2	0.000		0.000		0.000	

Source Calculated based on CHNS 1989–2011
Note
(1) ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table
(3) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table

7.5.2 The Results of the Impact of the Higher Education Expansion Policy on Wage by Gender

Does the impact of the HEEP differ by males and females? The results by gender are summarized in Table 7.6. It indicates that in both male and female groups, the impacts of the policy on wage are not statistically significant. It indicates that the

Table 7.6 Results of the impact of higher education expansion policy on wage by gender

Panel A: DID method				
	Female		Male	
	coef.	S.E.	coef.	S.E.
Treatment	0.290	0.323	0.035	0.252
Year	0.622***	0.138	0.641***	0.127
DID	−0.255	0.344	−0.060	0.264
Constants	1.655***	0.249	1.829***	0.236
Inverse Mills ratio	−1.011**	0.470	0.247	0.612
Observations	408		572	
Prob > chi2	0.000		0.000	
Panel B: DDD method				
	Female		Male	
	coef.	S.E.	coef.	S.E.
Treatment	−0.144	0.671	0.069	0.428
Year	−0.096	0.376	0.085	0.213
College	0.289	0.523	0.162	0.313

(continued)

Table 7.6 (continued)

Panel B: DDD method				
	Female		Male	
	coef.	S.E.	coef.	S.E.
Year * College	0.086	0.553	0.222	0.340
Year * Aged 21–25	0.077	1.570	−0.045	0.842
College * Aged 21–25	0.298	0.784	0.206	0.507
DDD	−0.270	1.748	−0.189	0.973
Constants	2.943	2.301	2.235*	1.200
Inverse Mills ratio	−1.446	1.615	−0.394	1.520
Observations	1,722		2,342	
Prob > chi2	0.999		0.690	

Source Calculated based on CHNS 1989–2011
Note
(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table
(3) In the second step examination, years of experience, health status, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table

gender disparities of the influence of the HEEP on wage is small. It may be caused by that the gender gap for the young college group is smaller than for the middle age or older age groups.

7.5.3 The Results of the Impact of the Higher Education Expansion Policy on Wage by Region and Hukou Groups

(1) *The results by region*

Table 7.7 summarizes the results by Eastern Region and no-Eastern Region (Western- and Central Region). It is shown that although the policy effect is a negative value for the Eastern Region and a positive value for the no-Eastern Region, these results are not statistically significant. The results indicate that the difference of the impact of the policy on college graduates wage between Eastern, Central and Western Region groups is small.

Two reasons may be considered for the results. First, during the 2000s, the Chinese government promoted the economic development in the Western, and

Table 7.7 Results of the impact of the higher education expansion policy on wage by region

Panel A: DID method				
	East		Central/West	
	coef.	S.E.	coef.	S.E.
Treatment	0.165	0.916	−0.050	0.253
Year	0.397	0.466	0.502***	0.116
DID	−0.060	0.933	0.221	0.295
Constants	2.401***	0.861	1.361***	0.260
Inverse Mills ratio	−2.740	2.035	−0.172	0.390
Observations	533		447	
Prob > chi2	0.000		0.000	
Panel B: DDD method				
	East		Central/West	
	coef.	S.E.	coef.	S.E.
Treatment	0.197	0.577	−0.097	0.187
Year	0.045	0.321	0.213**	0.090
College	0.321	0.439	0.169	0.137
Year * College	0.049	0.460	0.175	0.151
Year * Aged 21–25	−0.022	1.113	0.067	0.397
College * Aged 21–25	−0.039	0.662	0.415	0.222
DDD	−0.111	1.235	−0.313	0.466
Constants	2.880***	0.579	1.637***	0.202
Inverse Mills ratio	−3.359***	1.077	−1.572***	0.450
Observations	1,712		2,352	
Prob > chi2	0.796		0.000	

Source Calculated based on CHNS 1989–2011

Note

(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table

(3) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, and urban dummy variables are also estimated, these results are not presented in this table

Central Regions to reduce the regional disparity, and the GDP growth rate became greater for the Western and Central Regions than for the Eastern Region. For example, the GDP growth rate was 7.8% for the Western Region, 10.5% for the Central Region, and 7.2% for the Eastern Region in 2009 (NBS 2010). Currently, economic growth in Western and Central Regions may increase the college graduate labor demand in

these regions. Second, with the deregulation of the registration system, labor migrations between various regions became easier during the 2000s. Labor migration may cause the various regional wage levels convergence.

(2) ***The results by hukou type***

It is known that in China there remains the discrimination against migrants by the *Hukou* system, and there persists the wage gap between the local urban *hukou* residents and the migrants with rural *hukou* in Chinese urban labor market. The analyses for the rural *hukou* group and urban *hukou* group are summarized in Table 7.8. It suggests that the policy positively affects the wage of the migrants (Panel A); whereas, the policy negatively affects the wage of the local urban *hukou* residents (Panel B).

The reasons can be considered as follows. First, because there remains the discrimination against migrants during both the pre-policy period and the post-policy period, the wage is lower and the wage rise is smaller for the migrants (Ma 2018c). When there maintains the discrimination against migrants, even after the HEEP was implemented, for the migrant group, the wage gap of college graduates aged 21–25 and the group aged 31–40, the wage gap between the college graduates and the senior high school graduates, and the wage gap between pre-policy and post-policy may be smaller than those for the urban residents. Therefore, the results in Panel A show that the policy only negatively influenced the wage of local urban residents. Second, when the human capital and other factors are constant, because the average wage level is lower for migrants than local urban *hukou* residents, the labor demand for migrants may increase, which causes the migrant college graduates' wage rise during the post-policy period. Therefore, as it is shown in Panel B, the policy positively affected the

Table 7.8 Results of the impact of higher education expansion policy on employment by *hukou* type

Panel A: DID method				
	Urban		Rural	
	coef.	S.E.	coef.	S.E.
Treatment	0.213	0.210	−0.538	0.344
Year	0.633***	0.108	0.406***	0.135
DID	−0.301	0.221	0.819**	0.374
Constants	1.975***	0.180	1.514***	0.291
Inverse Mills ratio	−0.792*	0.515	−0.009	0.421
Observations	645		335	
Prob > chi2	0.000		0.000	
Panel B: DDD method				
	Urban		Rural	
	coef.	S.E.	coef.	S.E.
Treatment	0.126	0.130	−0.0133	0.401
Year	0.187**	0.080	0.144	0.182

(continued)

Table 7.8 (continued)

Panel B: DDD method				
	Urban		Rural	
	coef.	S.E.	coef.	S.E.
University	0.490***	0.106	0.267	0.323
Year * University	−0.018	0.163	−0.007	0.346
Year * Aged 21–25	0.309	0.346	−0.555	1.010
University * Aged 21–25	−0.700***	0.182	0.242	0.449
DDD	−0.008*	0.238	0.451	1.123
Constants	1.975***	0.180	2.819***	0.883
Inverse Mills ratio	−0.792*	0.515	−2.850***	0.788
Observations	2,342		1,857	
Prob > chi2	0.690		0.432	

Source Calculated based on CHNS 1989–2011
Note
(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table
(3) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, and region dummy variables are also estimated, these results are not presented in this table

wage of migrant groups. It indicates that there may remain the substitutions of labor demand for the young college graduates between the migrants and local urban *hukou* residents. More detailed study is needed on this issue.

7.5.4 Robustness Checks

(1) *Using various treatment groups*

Two types of treatment groups are used to investigate if the policy effect varies by treatment group constructions. The results are summarized at Table 7.9. Estimation 1 is the analysis using the college graduates aged 21–27 as the treatment group. Estimation 2 is the analysis using the college graduate aged 21–30 as the treatment group. It is found that the results for these two varied treatment groups are similar: the policy effects are not statistically significant. In comparison with the results of Panel A in Table 7.3 which uses the same model, it is indicated that the estimated results are sensitive for the treatment group setting.

Table 7.9 Results using various treatment groups

Estimation 1						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.010	0.397	0.182	0.389	−0.016	0.156
Year	0.675***	0.251	0.751***	0.233	0.594***	0.096
DID	−0.225	0.415	−0.309	0.404	−0.073	0.163
Exp.	−0.093	0.077	−0.092	0.071	−0.035	0.029
Exp-sq.	0.007	0.007	0.007	0.007	0.004	0.003
Health			−0.007	0.028	−0.009	0.012
Male			0.078	0.162	0.110*	0.064
Occupation (Clerk)						
Manager			0.235	0.186	0.3054***	0.073
Technician			0.016	0.251	0.042	0.097
Agri.			−0.095	1.077	−0.036	0.670
Manufacturing job (H)			−0.239	0.379	−0.170	0.147
Manufacturing job (L)			−0.256	0.541	0.041	0.228
Service			−0.008	0.363	0.013	0.142
Others			0.061	0.277	0.065	0.118
Regular worker					0.002	0.073
Private sector					−0.046	0.129
Urban					0.252***	0.071
Region (East)						
Central					−0.325***	0.099
West					−0.231**	0.111
Constants	2.167***	0.346	1.984***	0.390	1.797***	0.187
Inverse Mills ratio	−2.912**	1.307	−2.662**	1.137	−1.015*	0.580
Observations	1,116		1,116		1,116	
Prob > chi2	0.057		0.066		0.000	
Estimation 2						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	0.010	0.397	0.223	0.463	0.046	0.286
Year	0.675***	0.251	0.710**	0.329	0.554	0.207
DID	−0.225	0.415	−0.213	0.480	−0.027	0.297
Exp.	−0.093	0.077	−0.055	0.095	−0.024	0.058
Exp-sq.	0.007	0.007	0.004	0.009	0.003	0.006
Health			−0.008	0.035	−0.009	0.022

(continued)

Table 7.9 (continued)

Estimation 2						
	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Male			0.039	0.205	0.055	0.125
Occupation (Clerk)						
Manager			0.251	0.235	0.295**	0.141
Technician			0.056	0.320	0.070	0.189
Agri.			0.239	1.262	0.066	1.120
Manufacturing job (H)			−0.182	0.462	−0.142	0.276
Manufacturing job (L)			−0.317	0.664	−0.072	0.435
Service			−0.073	0.461	−0.074	0.274
Others			0.090	0.360	0.080	0.233
Regular worker					0.015	0.138
Private sector					−0.029	0.265
Urban					0.162	0.135
Region (East)						
Central					−0.246	0.207
West					−0.161	0.228
Constants	2.167***	0.346	2.040***	0.509	1.975***	0.362
Inverse Mills ratio	−2.912**	1.307	−3.766***	1.741	−2.201	1.413
Observations	1,454		1,454		1,454	
Prob > chi2	0.531		0.872		0.872	

Source Calculated based on CHNS 1989–2011

Note

(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

(2) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table

(3) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table

Why is the policy effect different for the college graduate group aged 21–25, and the group aged 21–27 or the group aged 21–30? It can be thought that a new college graduate aged from 21–25 searches for his (her) work in the first career period. When the labor demand is consistent, the increase of new college graduates labor supply may reduce the wage level of this group easily and quickly. Thus the results for the policy impact is more sensitive for the young college graduates who are aged 21–25 than for the group aged 21–27 or aged 21–30 years old.

(2) ***The Placebo test***

A placebo test is used to test the propriety of the DID/DDD methods used in the study. It is thought that the higher education expansion policy greatly affects the college graduate labor supply, whereas the influence of the policy on senior high school graduates is smaller. Therefore, when the senior high school graduate sample is used to take a similar analysis based on the DID method, the results should be different to that shown in Panel A of Table 7.3. In the placebo test, the treatment group is defined as the senior high school graduates aged 21–25, and the treatment group is defined as the senior high school graduates aged 31–40. The results are summarized in Table 7.10. It is found that the whole coefficients of DID items are not statistically significant. It is clearly that these results are different from those shown in Table 7.3.

Table 7.10 Results of the placebo test

	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Treatment	−0.539	0.416	−0.318	0.413	−0.342	0.394
Year	0.174	0.171	0.250	0.166	0.048	0.175
DID	0.237	0.306	0.206	0.313	0.223	0.304
Exp.	−0.073	0.087	−0.061	0.086	−0.039	0.081
Exp-sq.	0.001	0.006	0.000	0.005	0.000	0.005
Health			−0.008	0.027	−0.023	0.027
Male			−0.115	0.143	−0.146	0.140
Occupation (Clerk)						
Manager			0.096	0.206	0.106	0.190
Technician			0.240	0.269	0.177	0.247
Agriculture			−0.013	0.313	0.106	0.368
Manufacturing job (H)			−0.129	0.213	−0.125	0.201
Manufacturing job (L)			−0.232	0.218	−0.238	0.209
Service			0.004	0.213	−0.048	0.206
Others			−0.042	0.212	0.057	0.232
Regular worker					−0.008	0.131
Private sector					−0.055	0.234
Urban					−0.075	0.151
Region (East)						
Central					−0.218	0.149
West					0.070	0.203
Constants	2.653***	0.471	2.720***	0.565	3.125***	0.596

(continued)

Table 7.10 (continued)

	Model 1		Model 2		Model 3	
	coef.	S.E.	coef.	S.E.	coef.	S.E.
Inverse Mills ratio	−3.375***	0.990	−3.113***	0.926	−2.757***	0.775
Observations	1,892		1,892		1,892	
Prob > chi2	0.0276		0.094		0.807	

Source Calculated based on CHNS 1989–2011
Note
(1) *Note* ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
(2) Treatment group: senior high school graduates aged from 21 to 30 years old; Control group: senior high school graduates aged from 31 to 40 years old
(3) Heckman two step model is used. In the first step estimation, individual level variables including the age, health status, number of family members, gender, noearned income, urban hukou, region block (Central, Western Region), and region level variables including ratio of fixed asset investment to GDP, ratio of tertiary industry to GDP, ratio of trade to GDP, and GDP per capita are estimated, these results are not presented in this table
(4) In the second step examination, years of experience, health status, male, occupation, private sector, regular worker, urban, and region dummy variables are also estimated, these results are not presented in this table

7.6 Conclusions

In 1999, the Chinese government implemented a Higher Education Expansion Policy (HEEP). With the implementation of the policy, new college graduates increased yearly from 0.8 million to 6.1 million from 1999 to 2011 (NBS 2016). It is thought this dramatic increase in the college graduate labor supply may affect the wage level of young college graduates. Based on the quasi-natural experiment methods (DID method and DDD method, using six waves (1997, 2000, 2004, 2006, 2009, and 2011) longitudinal survey data from the Chinese Health and Nutrition Survey (CHNS), this study employs an empirical study to provide new evidences on the issue.

Five major conclusions emerge. First, in general, the HEEP does not affect the wage level of young college graduates; the difference of policy impact on wage by various wage centiles is small; the HEEP decreased the wage level of new college graduates in the short term (in 2004); whereas the negative effect disappears in the long term (in 2006, 2009, and 2011). Second, the gender disparity of the impact of the HEEP on wage levels of young college graduates is small. Third, the regional disparity of the influence of the policy on wage between Eastern Region and Non-Eastern Region (Central Region, Western Region) is small. But there maintains a larger difference of the policy effect between urban *hukou* group and rural *hukou* group. Concretely, the policy positively affects the wage of the migrants most of whom are with the rural *Hukou*, whereas the policy negatively affects the wage of the local urban *Hukou* residents. Fourth, the robustness checks confirms these results.

Based on these empirical study results, it suggests that although the gender differences of the impact of the policy on the wage level of new college graduates is smaller, for both female and male workers, in a short term, the policy may affect the

wage level of new college graduates, but in a long-term, the negative effect of the policy on wages may disappear. Wolf (2002), De Meulemeester and Rochat (1995) argued that higher education can contribute to economic growth by training intellectuals and facilitating scientific and technological innovation, or if the content of the courses is directed towards a productive objective. It indicates that from a long-term perspective, with economic growth and technological innovation, the labor demand for highly-educated labor should increase, and as a result the increase of college graduates supply can be absorbed. An important issue for the government is to promote the economic growth through the implementation of the HEEP and to upgrade industry structure based on the technological innovation.

Notes

1. In China there are two types of colleges: colleges with three years of study course, and universities with four or five years of study course. In the study, the two types are referred to simply as "college".
2. In China, college includes regular college and irregular college (such as colleges which provide education courses at night, or colleges which provide the education courses by television communication).
3. For the impact of higher education expansion policy on employment, please refer to Wu and Zhao (2010), Xing and Li (2011), Li et al. (2014), Yao et al. (2013), Knight et al. (2017) and Ma (2018a).
4. Regional level variables are obtained from the China Statistics Yearbook in each survey year.

Appendix

See Table 7.11.

Table 7.11 Descriptive statistics of variables

	College aged 21–25		College aged 31–40		Senior high aged 21–25	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
log.hourly wage	2.282	0.754	2.337	0.929	1.730	0.799
Exp	8	1	19	3	11	1
Number of family members	4	1	4	1	4	1
Health status	6.842	2.662	5.905	2.935	6.434	2.591
Male	0.596	0.492	0.586	0.493	0.549	0.498
Noearned income	48,077	90,626	38,849	41,826	32,475	50,876

(continued)

Table 7.11 (continued)

	College aged 21–25		College aged 31–40		Senior high aged 21–25	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Occupation						
Manager	0.247	0.433	0.459	0.499	0.103	0.304
Technician	0.075	0.265	0.139	0.347	0.029	0.169
Clerk	0.411	0.494	0.228	0.420	0.190	0.393
Agri.	0.000	0.000	0.003	0.051	0.026	0.158
Manufacturing job (H)	0.055	0.228	0.045	0.207	0.205	0.405
Manufacturing job (L)	0.021	0.142	0.011	0.102	0.136	0.343
Service	0.082	0.276	0.045	0.207	0.223	0.417
Others	0.110	0.313	0.071	0.257	0.088	0.284
Regular worker	0.568	0.497	0.793	0.405	0.458	0.499
Private sector	0.123	0.330	0.038	0.192	0.040	0.197
Urban hukou	0.699	0.460	0.657	0.475	0.520	0.501
Region						
East	0.664	0.474	0.613	0.487	0.505	0.501
Central	0.288	0.454	0.284	0.451	0.333	0.472
West	0.048	0.214	0.103	0.304	0.161	0.368
Regional level variables						
Ratio of fixed asset investment to GDP	0.417	0.147	0.426	0.162	0.447	0.164
Ratio of trade to GDP	0.422	0.155	0.454	0.178	0.340	0.079
Ratio of tertiary industry to GDP	0.513	0.524	0.453	0.452	0.257	0.286
GDP per capita	39,424	30,197	43,018	30,097	23,130	20,092
Survey year						
y1997	0.096	0.295	0.061	0.239	0.198	0.399
y2000	0.068	0.253	0.107	0.309	0.172	0.378
y2004	0.137	0.345	0.093	0.291	0.139	0.347
y2006	0.158	0.366	0.113	0.317	0.099	0.299
y2009	0.151	0.359	0.112	0.315	0.147	0.354
y2011	0.390	0.490	0.514	0.500	0.245	0.431

Source Calculated based on CHNS 1989–2011
Note Calculated based on total samples including females and males

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Correction to: Female Employment and Gender Gaps in China

Correction to:
X. Ma, *Female Employment and Gender Gaps in China*, Hitotsubashi University IER Economic Research Series 47, https://doi.org/10.1007/978-981-33-6904-7

The original version of the book was inadvertently published with an incorrect volume number, which has been changed from 48 to 47. The book containing an erratum has been updated with the changes.

In the original version of this book, the following belated corrections have been incorporated: In Chapter 3, Table 3.1 Descriptive statistics of variables, the total values of Number of children, Urban, Household income and Number of living parent have been updated. The book containing the errata has been updated with the following changes and the correct version of the table is given below:

The updated version of the book can be found at https://doi.org/10.1007/978-981-33-6904-7

X. Ma, *Female Employment and Gender Gaps in China*, Hitotsubashi University IER Economic Research Series 47, https://doi.org/10.1007/978-981-33-6904-7_8

Table 3.1 Descriptive statistics of variables

	Total		Care giving (a)		Non-care giving (b)		D
	Mean	S.D.	Mean	S.D.	Mean	S.D.	a–b
Labor participation	0.702	0.457	0.759	0.428	0.693	0.461	0.066
Parent care	0.137	0.344					
Education							
Low-education	0.899	0.301	0.797	0.402	0.915	0.279	−0.118
Middle-education	0.087	0.282	0.167	0.373	0.074	0.262	0.093
High-education	0.014	0.118	0.036	0.187	0.010	0.102	0.026
Age	55.817	6.828	51.921	5.547	56.437	6.808	−4.516
Health status							
Poor	0.257	0.437	0.184	0.387	0.268	0.443	−0.084
Fair	0.512	0.500	0.536	0.499	0.508	0.500	0.028
Good	0.136	0.343	0.161	0.368	0.132	0.338	0.029
Very good	0.085	0.279	0.108	0.310	0.082	0.274	0.026
Excellent	0.011	0.102	0.012	0.108	0.010	0.101	0.002
Having spouse	0.913	0.282	0.945	0.228	0.908	0.289	0.037
Number of children	2.462	1.242	2.022	1.022	2.532	1.259	−0.510
Urban	0.201	0.401	0.287	0.453	0.188	0.391	0.099
Household income	8.778	0.888	8.957	0.916	8.749	0.880	0.208
Number of living parent	0.509	0.688	1.047	0.643	0.423	0.656	0.624
Survey year							
y2011	0.425	0.494	0.457	0.498	0.420	0.494	0.037
y2013	0.575	0.494	0.543	0.498	0.580	0.494	−0.037
Observation	8,656		1,187		7,449		

Source Calculated based on China Health and Retirement Longitudinal Study (CHARLS) 2011 and 2013

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