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Published online: 14 Sep 2019.

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Changes in gender wage differentials in China: a regression and decomposition based on the data of CHIPS1995–2013

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ABSTRACT

Following the enactment of the Labour Law in 1995, China's urban labour market witnessed a divergence in both gender wage gap and discrimination against female workers before 2007, and thereafter a convergence in both. Contributions of endowment differentials between male and female workers to wage gap were diminishing because of the consistent improvement in the female workers' endowments. Discrimination against women, on the other hand, kept increasing and exceeded that of endowment differentials and eventually became the dominating contributor by 2002. Driven by the optimisation of female workers' endowments, the execution of new labour market legislation, the transformation of previously limitless labour supply into shortage, as well as the reform of income distribution policies, a long-term trend of convergence in both gender wage gap and discrimination has been forming. China has been striding forward into a society with more equity and justice ever since 2007.

1. Introduction

Since the reform and opening up in 1978, the average economic growth rate in mainland China from 1980 to 2010 was about 9.75%, 9.99%, 10.29%, and 11.31%, much higher than the world average economic growth rate during the same period. However, at the same time of rapid development, problems such as uneven urban and rural development and differences in labour wages have also arisen (Chen, Lin, Chou, & Chen, 2018). China's labour market has seen a series of profound changes since the mid-1990s. In 1992, a new reform agenda was ratified by the 14th Congress of the Chinese Communist Party, which proclaimed that one of the reform goals was to establish a 'socialist market economy'. From 1992 to 1993, state-owned enterprises

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initiated their employment reforms. Firms were given more autonomy and discretion in setting wages and bonuses and also in decision-making regarding recruitment, lay-offs, and termination of the contract. Workers, too, were given more freedom to negotiate with employers regarding rewards and work conditions, and even choose employers they would work for. In 1994, the Labour Law was passed and became effective in 1995; it further increased the flexibility of labour allocation and also brought the labour market construction into a legal track. In 1998, the Ministry of Labour was renamed as the Ministry of Labour and Social Security to administrate social insurance and related affairs for all workers associated with different kinds of enterprise. In December the same year, Regulations on Unemployment Insurance was promulgated by the State Council. In 1997, state-owned enterprises launched a new wave of labour market reforms with the purpose of reducing inefficiency leading to 25.533 million workers being laid off in the following four years, which accounted for 23.7%[1] of the total number of employees in state-owned enterprises in 1997. In 2004, a segmental labour supply shortage, *Min Gong Huang*, occurred in Dongguan and a few other coastal cities, which developed into a comprehensive shortage across the nation until 2010. In 2007, the Standing Committee of the National People's Congress passed the New Labour Contract Act that specified in detail both employer and employee behaviours in the making, changing and terminating of contracts. In 2012, the 18th National Congress of CPC decided to deepen income distribution system reforms so that everybody could share in the fruits of development. In 2013, the State Council issued the Several Opinions on Deepening Income Distribution Reform, which declared narrowing of the income gap as one of the four main reforming goals. In 2014, the State Council published the Opinions on Carrying on the Reform of Household Registration System, which kicked off reforms in the Hukou System. Millions of migrant workers started to settle in towns, cities and metropolitan areas where they had been working for many years. China's segmented labour market started to move toward integration. Market-oriented reform in the employment system, with its goal of establishing an orderly, flexible, and effective labour market mechanism, was one of the most important moves in China's economic transition. The reform has undoubtedly been successful in both boosting market vitality and improving economic efficiency. However, researchers note that it has also degenerated the gender inequality in the urban labour market and it is becoming more and more difficult for women to be employed (He, Liu, & Xu, 2016; Jiang, 2007; Yao & Xie, 2006). Additionally, the ratio of female to male earnings has consistently been falling.[2]

What accounts for the increasing gender wage differential and the dramatic changes in China's labour market over the past two decades? How have human capital and discrimination factors changed, and to what extent do they contribute to the gender wage gap? Is discrimination against female workers mainly stemming from wage discrimination internally or employment discrimination externally? Understanding these questions not only helps us to accurately address issues of women's basic rights and economic efficiency, but it also provides a framework e to explain, evaluate and design the ongoing reforms in the labour market.

The purpose of this paper is to explore the trends in gender wage differentials in the Chinese labour market between 1995 and 2013. The study applies CHIP's (China

Household Income Project) data from 1995 to 2013 to document changes in gender wage gap and discrimination against women in the urban labour market, and to analyse the dynamics behind these changes. The contribution of this paper is mainly reflected in the following two parts. First, it uses 18 years of data to analyse wage differential and discrimination based on four distinct cross-sectional data. This allows for the ability to provide a more comprehensive analysis of the gender wage gap and discrimination, and the possibility to predict the trends compared to other research on the same topic that uses data only from either one point (Ning, 2011; Zhao, 2014) or two periods (Zhang & Guo, 2012) of time. Secondly, the paper also utilises the maximum likelihood estimation of Heckman's sample selection model to control for the sample selection bias caused by the omission of unemployed individuals. We also use a modified Appleton decomposition methodology to manage the dual index number problem, thereby improving the accuracy of the results. Our research indicates that China's urban labour market witnessed a divergence initially followed by convergence in both the gender wage gap and discrimination against female workers. A long-term trend of convergence in both the gender wage gap and discrimination has been forming. China has been striding forward into a society characterised by more equity and justice since 2007.

The remainder of the paper is structured as follows. Section 2 provides a literature review on gender wage gap and discrimination. Section 3 overviews the methodology we utilised to conduct the analysis in this paper. Section 4 is the statistical description of data used in the paper. Section 5 breaks down the gender wage gap for each of the four datasets from 1995, 2002, 2007, and 2013 based on regressions. Section 6 presents and compares the results of the decomposition. The final section draws conclusions, and also discusses the limitations of the study and areas for future research and improvement.

2. Literature review

Economic transition and market-oriented reforms may have a multi-dimensional effect on gender wage gap. First, the market-oriented reforms in the allocation of labour may weaken occupational segregation such that women move from 'overcrowded' 'female occupations' to 'male occupations', which would induce an increase in women's wages and narrow the gender wage gap accordingly. Secondly, increase in women's educational attainment and labour participation rate will result in narrowing of the gender wage gap in two ways, namely, improvement in women's endowments, and decrease in statistical discrimination, which is assumed to be originating from the anticipation of differences in gender average productivity (Yip & Wong, 2014). Thirdly, socio-cultural changes generally benefit women immensely, improving their social status, enhancing their professional identity, and most importantly narrowing the gender wage gap by weakening the employer, customer and peer-worker's discriminating preference against women (Becker, 1985). However, things may also go in the opposite direction. Women may lose the protection of the government's equal employment policy during the process of marketisation. Women tend to choose occupations with lesser requirement of technical skills

and knowledge, and therefore accept lower pay in order to maintain an appropriate balance between work and life. This evidently results in lower wages for women relative to their male counterparts (Brainerd, 2000). Economic structure, changes in income, law enforcement and other unobserved factors may also impact gender wage gap (Blau & Kahn, 1999), which is why the magnitudes, trends and causes of gender wage differential differ from nation to nation, development-phase to development-phase in the same country, and even state to state within the same nation during the same time-period. Gender wage gap is more likely an empirical rather than a theoretical issue.

Trends in gender wage gap and discrimination in Eastern European countries and the former Soviet Union have moved in opposite directions during a similar process of economic transition from planned to market economy in both regions. The post-transition female to male wage ratio decreased in Ukraine and Russia because of widening wage distribution, but increased in Eastern European countries because of reduced discrimination, rising returns to education and also the fact that women in those countries were better educated and trained (Brainerd, 2000). Elena and Mroz (2000) found that gender inequality declined significantly in the lowest percentiles of the Russian distribution, increased in the upper percentiles, and was stable in the interquartile range. The net effect was a relatively small change in gender inequality, on average, between 1992 and 1995. A research conducted by Jolliffe and Campos (2005) indicated that the male-female differences in log wages declined from 0.31 to 0.19 between 1986 and 1998, which is largely explained by a matching decline in Oaxaca's discrimination.

In Southeast Asian countries, trends and causes of gender wage differentials vary. Deshpande, Goel, and Khanna (2018) used nationally representative data from the Employment-Unemployment Surveys in 1990–2000 and 2009–2010 to explore gender wage gaps among regular wage workers in India. They found that the wage ratio of women to men decreased from 55% in 1999–2000 to 49% in 2009–2010, and the bulk of the gender wage gap was unexplained. They also found that over the decade, while the wage-earning characteristics of women improved relative to men, the discriminatory component of the gender wage gap increased. If women were 'paid like men' in 2009–2010, they would have earned more than men on account of the improvement in their wage-earning characteristics. Ahmed and McGillivray (2015) investigated changes in the gender wage gap in Bangladesh over the period 1999–2009 and found that the gap in average wages between men and women decreased by 31% over this period. The key driver of this change was an improvement in female educational qualifications. They also found that the gender wage gap narrowed much more at the lower end of the wage distribution, which is attributed largely to a decline in discrimination against women.

The gender wage gap and the level of discrimination in the United States consistently decreased at the federal level, with wide variations across different states over the past 30 years. Suh (2010) studied the determinants and characteristics of changes in gender wage gap in the United States between 1989 and 2005 and found that the wage ratio of women to men increased from 74.0% to 80.4% during the period studied. He attributed this change mainly to the increase in women's experience,

work hours, and education. A diminishing level of discrimination in the labour market also played an important role. Balance (2012) reported that the gender wage gap in the United States fell from 0.4357 log points over the period of 1980–1984 to 0.2673 log points over the period of 2005–2010 at the federal level. The narrowing of the gender wage gap was mainly attributable to a reduction in the level of gender discrimination. Balance's estimation at the state level also showed a significant decrease in gender wage gap over the period 1980–2010. However, there were wide variations observed in gender wage gap and level of discrimination across the US states. In other related studies, Hofer, Titelbach, Winter-Ebmer, and Ahammer (2017) analysed wage discrimination against immigrants in Austria using combined information from the labour force surveys and administrative social security data. The empirical results indicated that immigrants experience a wage penalty of 15 percentage points compared with natives. Blau and Kahn (2000, 2017) concluded that the limitation of wage regressions is that the coefficient on the gender variable could capture intrinsic differences between men and women rather than the effects of gender discrimination. If male workers perform better in ways that are unobservable to the researcher, a wage regression will overestimate the extent of discrimination against women. Alternatively, discrimination is underestimated if the control variables in wage regressions are themselves affected by discrimination. Bernal, Vásquez, and Edwards (2018) tested whether there was a significant salary difference between women and men working as faculty in Marriage and Family Therapy (MFT) programmes within public universities. The main results indicated no evidence of salary discrimination against women working as MFT faculty members but showed that women were shown to have significantly less time in academia and to publish significantly fewer peer-reviewed journal articles than men.

Gender wage gap and discrimination in China received attention from the academic community in the late 1990s, and literature on this topic saw a substantial increase after 2000. Dong and Zhang (2009) employed firm-level data to analyse gender wage differentials in Chinese industries in the late 1990s and concluded that employers' discrimination against women was not a significant source of the gender wage gap. Instead, they found that the relative wage of unskilled female to male workers was higher than their relative productivity, which consequently accounted for a disproportionate share of the labour surplus in state-owned enterprises. Huang (2010) used the data from Survey on Temporary Residents in Cities 2002 conducted by The Institute of Economics of the Academy of China's Social Science to explore the gender wage gap among migrant workers. He found that 80.7% of the gender wage gap was attributable to discrimination and only 19.3% was attributable to differences in human capital endowment. Peng (2010) utilised CGSS 2006 data and Brown methodology to examine the rates of return to education among the highly educated and gender wage disparities. He found that discrimination was the main reason for the gender wage gap, while human capital differentials explained only one fourth of the wage gap. Magnani and Zhu (2012) employed the migrant population data from CHIP 2002 to analyse gender wage differentials among migrants in China. They found that male migrants earned 30.2% higher hourly wages than female migrants. Discrimination effects contributed more to the wage gap than endowment effects throughout the wage distribution. They also ascertained that the relative gender wage

discrimination problem was most serious among low income migrants. Chen et al. adopted enterprise level dataset to identify the link between globalisation and gender inequality in China's labour market, and found that the large gender wage gap in foreign and exporting firms was mainly caused by differences in gender productivity. They also found that gender wage discrimination was observed only among private non-exporting firms. Qing and Zheng (2013) analysed the data of CGSS 2006 to study the effects of hierarchical segregation on gender wage disparity. They concluded that 41% of the total gender log hourly earnings differentials were observed across job levels. Much of the unexplained differences accounted for wage discrimination within job levels, and a quarter of the total gap was attributable to gender discrimination in job promotion. Chen and Zhou (2014) studied the effects of occupation choice on gender discrimination. Although there are large differences in these studies with respect to their objectives and the decomposition methodology employed in them, each of them similarly focus on an analysis at one point of time and do not engage in evolvement of gender wage gap and discrimination over a long period of time.

Two studies are closely related to our research. Zhang, Han, Liu, and Zhao (2008) used urban household survey data to analyse changes in gender wage gap in urban China over the period1988–2004. They found that the mean female to male wage ratio declined from 86.3% to 76.2%, rapid increases in returns to both observed and unobserved skills mainly being responsible for this diverging trend. Increased discrimination served to widen the gender wage gap as well. Since the data they used ranged from 1988 to 2004, their results cannot accurately reflect the dynamics in gender wage gap in China's labour market after that time-period. Zhang and Guo (2012) employed CHIPS data to decompose the changes in gender wage gap in urban China's labour market over the period 1995–2002, and determined that the gender wage gap increased during that period, which was completely attributable to gender discrimination. Since their paper focused on the effects of professional segregation on gender wage differential and analysed two cross-sectional datasets in a short time-period, their study does not reveal the trends and causes of changes in gender wage gap and discrimination over long time-periods. However, the government of China has, over time, launched a series of profound reforms in the urban labour market. Furthermore, there is a significant flaw in Brown methodology. It uses male workers' wage structure as the non-discrimination wage structure and male employment probability as the non-discrimination employment probability to break down gender wage gap. This leads to the problem of 'dual index number', and therefore the results of decomposition are unstable.

3. Models and methodology

A standard method to decompose wage differential is to estimate the expanded Mincer equation where the natural logarithm of hourly wage is regressed against human capital variables, individual characteristic variables, family background variables, and structure variables. Consider the following:

$$\ln(w_i) = X_i\beta_i + \varepsilon_i \tag{1}$$

where $i = 1, 0$; 1 representing male and 0 representing female, w_i is vector for hourly wage, X_i is the matrix of predictors, β_i is the vector of parameters, and ε_i is

the vector of regression disturbances. The variables used in the wage equation are listed below.

Individuals who are in the labour force but are not employed have been omitted from the sample because they do not have any wage information. Therefore, OLS estimates for Equation (1) yield a sample selection bias and hence violate the requirement of Gauss Markov assumption, which states the expected value of the error term must be equal to zero (Heckman, 1979). To account for this bias, we apply the maximum likelihood estimation of Heckman's sample selection model to translate the sample selection bias into an omitted variable bias which can then be corrected for by estimating an Inverse Mills Ratio (IMR). IMR is estimated using a logistic model that assumes a value of 1 if the person has an observed wage and 0 if the person does not have wage information but is still in the labour force. If we assume that each person has a reservation wage for which he or she will accept a job, we can develop a model presented in Equation (2) that controls for these variations.

$$p_i = \frac{e^{X_i Z_i}}{1 + e^{X_i Z_i}} \tag{2}$$

where $i = 1, 0$; representing male and female, respectively, p_i is the probability of accepting a job, X_i is the vector of explained variables, and Z_i is the vector of parameters. Three factors, namely, education, experience, and region are included in Equation (2), defined in the same way as in Table 1. Based on the estimation of Equation (2), IMR is calculated as follows:

$$\text{IMR}_i = \frac{\varphi(X_i Z_i)}{\emptyset(X_i Z_i)} \tag{3}$$

where $\varphi(X_i Z_i)$ is the density function, and $\emptyset(X_i Z_i)$ is the distribution function.

The IMR, then, is added to the wage equation as an additional explanatory variable. The amended equation is:

$$\ln(w_i) = X_i \beta_i + IMR_i \gamma_i + \varepsilon_i \tag{4}$$

where γ_i is the coefficient vector for IMR_i. A statistically significant coefficient indicates that there are sample selection issues which would bias the estimation if IMR_i is not included.

After regressing male wage and female wage equations according to Equation (1), Blinder (1973) and Oaxaca (1973) proposed that the mean wage gap should be separated into two components, the explained and unexplained components. The decomposition equation is shown below:

$$\overline{\ln(w_m)} - \overline{\ln(w_f)} = X_m \beta_m - X_f \beta_f = (X_m - X_f)\beta_m + (\beta_m - \beta_f)X_f \tag{5}$$

The term $\overline{\ln(w_m)} - \overline{\ln(w_f)}$ is the mean logarithm of wage differentials between male and female workers. X_m and X_f are the vectors of explanatory variables evaluated at the mean for each gender. β_m and β_f are the vectors of the regression

Table 1. Wage equation variables.

Name	Definition
Natural Logarithm of Hourly Wage	$=\ln\{(E/M*D*H)\}$, where $E=$ annual earnings calculated at prices of 2013, $M=$ average months worked in the past year, $D=$ average days worked per month and $H=$ average hours worked per day
Education	$=$ years of formal education received
Experience	$=$ years employed
Experience 2	$=$ experience squared
Sex	$=1$ if male, $=0$ if female
marriage	$=1$ if respondent is first-married, remarried, divorced, widowed, $=0$ if cohabiting and never married
Ownership (collective enterprises as the benchmark)	
State-owned	$=1$ if respondent works for solely state owned/state holding enterprises, Sino-foreign joint venture/solely foreign owned enterprises, $=0$ otherwise
Private	$=1$, if respondent works in government and party agencies, public institution, individual enterprises, private enterprises, $=0$ otherwise
Industry (agriculture, forestry, animal husbandry and fishery as the benchmark)	
Finance	$=1$ if respondent works in financial industry; information transmission, software and information technology services; scientific research and technical services, $=0$ otherwise
Manufacturing	$=1$ if respondent works in mining; manufacturing; production and supply of electricity, gas and water; construction;/wholesale and retail trades; transportation, storage and post, accommodation and catering services; real estate; leasing and business services; management of water conservancy; environment and public facilities; residential services, repairing and other services; education; health and social work; culture, sports and entertainment; public management, social securities and social organizations; international organizations, $=0$ otherwise
Administrator	$=1$ if the occupation is professional; manager; director of government agent, institution and enterprise; department director of government agent, institution and enterprise; $=0$ otherwise
Region (the western region as the benchmark)	
East	$=1$ if works in Beijing, Liaoning, Shanghai, Jiangsu, Shandong, Guangdong, $=0$ otherwise
Central	$=1$ if works in Shanxi, Anhui, Henan, Hubei, Hunan, $=0$ otherwise

Note: There is a slight difference in the classification criteria by industry, occupation and ownership in each of the four years. We have assigned values to all related variables in this paper according to the definitions above uniformly.

coefficient to male wage equation and female wage equation, respectively, which we also refer to as the wage structure. The term $(X_m-X_f)\beta_m$, which measures the differential due to differences in predictors, is considered to be a justifiable proportion of the wage disparity. The term $(\beta_m-\beta_f)X_f$ measures the difference in the coefficients between men and women, which indicates discrimination against women.

It is important to note that by the Oaxaca–Blinder method, both the male wage structure, β_m, and the female wage structure, β_f, are equally employable as the decomposition benchmark. The results of decomposition by the Oaxaca–Blinder method are, therefore, unstable. This is the so-called 'index number problem'. To deal with this problem, Neumark (1988) suggested taking the matrix of the regression coefficients to a pooled sample of male and female workers as the non-discriminatory wage structure. Neumark decomposition methodology is shown below:

$$\overline{\ln(w_m)} - \overline{\ln(w_f)} = (X_m-X_f)\beta + (\beta_m-\beta)X_m + (\beta-\beta_f)X_f \qquad (6)$$

where β is the vector of regression coefficients to the pooled sample of male and female workers that represents the non-discriminatory wage structure, $(X_m-X_f)\beta$ captures the difference in endowments between men and women, $(\beta_m-\beta)X_m$ denotes

a treatment advantage to men, and $(\beta - \beta_f)X_f$ denotes a treatment disadvantage to women. The last two items of the equation together account for the discrimination against women.

However, Neumark's decomposition may enlarge the wage discrimination by failing to consider the difference in employment probability between men and women. Appleton improved Neumark's method by overcoming this flaw and proposing the following decomposition equation:

$$
\begin{aligned}
p_{MA}\overline{\ln(w_m)} - p_{FA}\overline{\ln(w_f)} &= p_N(X_m - X_f)\beta + p_N(\beta_m - \beta)X_m \\
&\quad + p_N(\beta - \beta_f)X_f + (p_{MN} - p_N)\overline{\ln(w_m)} + (p_N - p_{FN})\overline{\ln(w_f)} \quad (7) \\
&\quad + (p_{MA} - p_{MN})\overline{\ln(w_m)} + (p_{FN} - p_{FA})\overline{\ln(w_f)}
\end{aligned}
$$

where p_{MA} is the actual employment probability of men, p_{FA} is the actual employment probability of women, p_N is the non-discriminatory employment probability of the entire labour force, p_{MN} is the non-discriminatory employment probability of men, and p_{FN} is the non-discriminatory employment probability of women. To keep it simple, we set I$=p_N(X_m - X_f)\beta$, II $=p_N(\beta_m - \beta)X_m$, III$= p_N(\beta - \beta_f)X_f$, IV $= (p_{MN} - p_N)\overline{\ln(w_m)}$, V $= (p_N - p_{FN})\overline{\ln(w_f)}$, VI$=(p_{MA} - p_{MN})\overline{\ln(w_m)}$, and VII $= (p_{FN} - p_{FA})\overline{\ln(w_f)}$. I $+$ IV $+$ V, then, captures the component caused by gender endowments differentials; II $+$ III $+$ VI $+$ VII captures discrimination against women; II $+$ III is the portion stemming from different returns to endowments between men and women; and VI $+$ VII is the portion attributable to the discriminatory employment probability.

4. Data and descriptive statistics

Given the objectives we want to achieve, the data set used in this analysis must ①* cover enough time span to include all the important events that happened in the reformation of China's labour market system, ② have an appropriate interval between each cross-section to reflect the prospective changes, both in wage gap and discrimination, ③ contain a large enough sample to secure an unbiased analysis to subsamples and all human capital variables, individual characteristic variables, and other structural variables in both employment and wage equations. China Household Income Project (CHIP) meets all our requirements above and has been chosen as the data source for the analysis in this paper. CHIP was initiated by the Institute of China's Income Distribution, Beijing Normal University in 1988, and up to 2013 five cross-sectional datasets were released. The questionnaire in 1988 differs considerably from the questionnaires of other years. Therefore, we chose only four sets of data from the urban household survey in 1995, 2002, 2007, and 2013 in order to maintain consistency.

Within each cross-sectional data, we excluded individuals aged below 16 years and above 60 years, full-time homemakers, and re-employed retirees under the retirement age to ensure the sample in question fell within the scope of the labour force. We also excluded individuals who were employers or self-employed, as well as family-workers to ensure that all the samples were wage earners. Moreover, samples with

Table 2. Changes in the characteristics of gender gap from 1995 and 2013.

Variables	1995	2002	2007	2013
Education	0.59434	0.09618	0.04252	−0.15683
Experience	2.87367	3.39505	3.20996	2.64891
Experience Squared	139.0371	153.5682	161.8337	132.3237
Marriage	−0.011091	0.004052	−0.012249	−0.007899
Ownership (collective enterprise as the benchmark)				
State-owned	0.072555	0.06614	0.038398	0.069577
Private	0.01316	0.007718	−0.02076	−0.051835
Industry (agriculture, forestry, animal husbandry and fishery as the benchmark)				
Finance	0.001346	0.002114	0.00058	−0.004755
Manufacturing	−0.012069	0.003452	−0.000852	0.000848
Administrator	0.093439	0.078363	0.081629	−0.016132
Region (western region as the benchmark)				
East	0.001609	0.003293	0.010192	−0.012529
Central	0.009126	0.005019	0.004912	0.02493
Hourly log wage gap	0.138966	0.170221	0.25637	0.242546

missing data were also excluded. After data-trimming, the data of 1995 consists of 11,347 labour-force samples and 10,906 employee samples from the provinces of Beijing, Liaoning, Jiangsu, Guangdong, Shanxi, Anhui, Henan, Hubei, Sichuan, Yunnan, and Gansu. The data of 2002 consists of 11,022 labour force samples and 9,556 employee samples from the 11 provinces above, and additionally from Chongqing. The survey of 2007 has lesser data with 6731 labour force samples and 9,556 employee samples available. The survey of 2013 expanded to include a total of 14 provinces, with Shandong and Hunan as additions to the 12 provinces previously included in 2002. A total of 8,813 labour force samples and 8,141 employee samples are available in the survey of 2013.

Table 2 reports changes in the characteristics of job and human capital during the 18-year period from 1995 to 2013. The hourly log wage gender gap in the years of 1995, 2002, 2007 and 2013 are 0.138966, 0.170221, 0.25637, and 0.242546, respectively. This suggests that the gender wage gap experienced a monotonic increase prior to 2007 and a decreasing trend thereafter. Up until 2007, male workers' human capital and job characteristics were superior to female workers, measured in terms of education, experience, and employment in state-owned enterprises, the eastern region, and finance industry, and employment as professionals or administrators. However, women made significant improvements in narrowing the gap in almost all the categories above during the period studied and exceeded men in 2013, with the exception of experience and employment as professionals or administrators. Impressively, women recorded a larger increase in educational attainment than men, which resulted in a consistent narrowing of the gender gap from 0.59434 in 1995 to −0.15683 in 2013. There were more women married than men during the period of study, except in 2002. The number of women employed in manufacturing vis-à-vis men fluctuated over the 18-year period. The gender gap in the category of employment in the central region has been positive and getting larger ever since 2007, which implies more and more men are choosing to work in central China. The proportion of women employed in private enterprises was lower than men before 2002, but became higher after that year and an even larger increase was witnessed in the following years.

5. Regression and decomposition, a case of 2013[3]

Table 3 reports the results of estimated coefficients and standard errors from the general human capital model using the sample of males and females from 2013. Testing for residual sequence indicates that there is no heteroscedasticity or autocorrelation, and that the regression complies with basic econometric assumptions. P values for F-statistics in the four specifications all equal zero, which signals that the models fit well overall. As expected, all human capital and job characteristic variables in all the four equations are significant factors of wage in 2013 with only an exception of 'manufacturing' in Equation (1) and 'central region' in Equations (2)–(4), which indicates that the variable selection is reasonable.

Gender in Equation (1) is one of the significant factors of wage determination, its coefficient being 0.236648. This means that men received substantially higher wages than women, implying the possible gender discrimination in China's labour market. If other conditions had remained the same, men would have been paid more than women by 23.6648% in 2013. Comparison coefficients in Equations (3) and (4) reveal that the rate of return to experience, employment in finance industry and manufacturing, employment as professionals or administrators, and employment in the eastern region for men are positive and higher than women. This indicates a possible

Table 3. Results of OLS regression for wage models, 2013.

Independent variables	Equation 1 for overall	Equation 2 for overall	Equation 3 for male	Equation 4 for female
Constant	0.854003*** (0.083108)			
Education	0.077333*** (0.003005)	0.096098*** (0.002736)	0.091695*** (0.003500)	0.098455*** (0.004166)
Experience	0.026208*** (0.002982)	0.034270*** (0.002975)	0.041321*** (0.003932)	0.032007*** (0.00452)
Experience Squared	−0.000422*** (0.000062)	−0.000466*** (0.000062)	−0.000610*** (0.000080)	−0.000522*** (0.000101)
Sex	0.236648*** (0.015274)			
Marriage	0.084995*** (0.030109)	0.073750** (0.030668)	0.091995** (0.040621)	0.098821** (0.045909)
Ownership (collective enterprise as the benchmark)				
State-Owned	0.268500*** (0.026797)	0.335869*** (0.027110)	0.296457*** (0.035274)	0.329583*** (0.041814)
Private	0.112997*** (0.023187)	0.168232*** (0.023294)	0.146046*** (0.031334)	0.1913*** (0.033927)
Industry (agriculture, forestry, animal husbandry and fishery as the benchmark)				
Finance	0.207975*** (0.071377)	0.759039*** (0.051676)	0.821142*** (0.065342)	0.686817*** (0.078717)
Manufacturing	0.051057 (0.065596)	0.610244*** (0.042776)	0.677965*** (0.053029)	0.514814*** (0.065822)
Administrator	0.211658*** (0.018409)	0.181869*** (0.018704)	0.190176*** (0.024476)	0.172392*** (0.028063)
Region (western region as the benchmark)				
East	0.197423*** (0.019577)	0.219521*** (0.019904)	0.242885*** (0.026107)	0.205319*** (0.029742)
Central	−0.034170* (0.020290)	0.001332 (0.020558)	0.035225 (0.026723)	−0.039994 (0.031087)
Adjusted R^2	0.224706	0.189371	0.182069	0.203481
observation	8141	8141	4570	3571

Notes: Figures in parentheses are standard errors. ***, ** and * denote that the t-statistics are significant at 1%, 5%, and 10% level, respectively.

Table 4. Results of logistic regression for job obtainment models, 2013.

Independent variables	Equation 5 for overall	Equation 6 for overall	Equation 7 for male	Equation 8 for female
Constant	−1.037640***	−0.817190***	−0.574348	−0.742539**
	(0.244925)	(0.240405)	(0.365238)	(0.335461)
Education	0.120432***	0.126554***	0.093146***	0.131191***
	(0.015388)	(0.015235)	(0.02337)7	(0.020907)
Experience	0.091480***	0.096419***	0.113061***	0.083766***
	(0.014540)	(0.014485)	(0.022194)	(0.019538)
Experience Squared	−0.001849***	−0.001841***	−0.002237***	−0.001790***
	(0.000281)	(0.000280)	(0.000421)	(0.000389)
Sex	0.618140***			
	(0.084150)			
Marriage	0.818891***	0.695406***	1.034424***	0.547917***
	(0.144780)	(0.142707)	(0.215760)	(0.201964)
Region (western region as the benchmark)				
East	0.693709***	0.689933***	0.772560***	0.636105***
	(0.104724)	(0.104264)	(0.157847)	(0.140059)
Central	0.309612***	0.325016***	0.527698***	0.154716
	(0.099713)	(0.099226)	(0.152148)	(0.132619)
S.E. of regression	0.259802	0.260561	0.229169	0.292065
McFadden R-squared	0.073727	0.062178	0.084138	0.058026
Observation	8813	8813	4854	3571

Notes: Figures in parentheses are standard errors. ***, ** and * denote that the z-statistics are significant at 1%, 5%, and 10% level, respectively.

discrimination against women in these factors. The rate of return to education, marriage, employment in state-owned and private enterprises are positive but lower for men than women, implying a possible reverse discrimination against men.

Table 4 lists the results of logistic regression from job obtainment equation for overall labour force, male labour force, and female labour force, respectively, in 2013. The coefficient of gender in Equation (5) is 0.618140 with a level of significance of 1%, which indicates that men find it easier than women to obtain a job in the labour market. Comparison coefficients in Equations (7)–(8) indicate that education, experience, marriage, and employment in the eastern region benefit the entire labour force in job seeking; but experience, marriage, and employment in the eastern region contribute more for men than women, while education contributes more for women than men. The negative experience squared term indicates that experience contributes to the increasing probability of job obtainment in a diminishing way. Employment in the central region favours men but it is not a significant factor for women.

Table 5 reports the results of regression without sample selection bias by employing Heckman two-step methodology. Note that the coefficients of IMRs in the four equations are highly significant at 1%, indicating that there would be sample selection bias if IMRs were not added to the model. Compared to Table 3, we see increase in the rates of return to experience, marriage, employment as professionals or administrators, employment in the eastern and central regions; and marginal decrease with varying magnitudes in rates of return to other factors in the male wage equation. We also notice that the rates of return to education, experience, marriage, employment as professionals or administrators, employment in the eastern and central regions increase; and the rates of return to other factors decrease in the female wage equation.

Table 5. Results of Heckman two-step regression for wage models, 2013.

Independent variables	Equation 9 for overall	Equation 10 for overall	Equation 11 for male	Equation 12 for female
Education	0.100686***	0.106462***	0.091425***	0.112117***
	(0.002823)	(0.002839)	(0.003457)	(0.004418)
Experience	0.045547***	0.048205***	0.055598***	0.048886***
	(0.003118)	(0.003158)	(0.004103)	(0.004884)
Experience Squared	−0.00080***	−0.000808***	−0.000980***	−0.001003***
	(0.000067)	(0.000068)	(0.000086)	(0.000114)
Sex	0.235217***			
	(0.015255)			
Marriage	0.243825***	0.229435***	0.359608***	0.207769***
	(0.032455)	(0.032911)	(0.047186)	(0.047167)
Ownership (collective enterprise as the benchmark)				
State-Owned	0.265317***	0.293489***	0.247129***	0.285397***
	(0.026758)	(0.027081)	(0.035137)	(0.041706)
Private	0.107079***	0.113075***	0.085403***	0.130066***
	(0.023180)	(0.023511)	(0.031454)	(0.034325)
Industry (agriculture, forestry, animal husbandry and fishery as the benchmark)				
Finance	0.173675**	0.150128**	0.249355***	0.051183
	(0.070171)	(0.071168)	(0.083555)	(0.107262)
Manufacturing	0.015474	−0.001633	0.102181	−0.122965
	(0.064375)	(0.065296)	(0.074829)	(0.098569)
Administrator	0.210092***	0.202979***	0.218128***	0.197038***
	(0.018352)	(0.018612)	(0.024312)	(0.027925)
Region (western region as the benchmark)				
East	0.330998***	0.343039***	0.378726***	0.332623***
	(0.021823)	(0.022124)	(0.028702)	(0.032935)
Central	0.033530*	0.045162**	0.115616***	−0.033343
	(0.020397)	(0.020678)	(0.027427)	(0.030782)
IMR	0.171499***	0.188673***	0.185396***	0.238629***
	(0.015138)	(0.015316)	(0.017209)	(0.027674)
R^2 Squared	0.226842	0.204227	0.202378	0.219781
Observation	8141	8141	4570	3571

Notes: Figures in parentheses are standard errors. ***, ** and * denote that the t-statistics are significant at 1%, 5%, and 10% level, respectively.

We have used Equations (6) and (7) to decompose the gender wage gap and listed the results in Tables 6–8. According to Table 6, endowment effects account for 8.0784% of the total gender wage differential, and price effects account for 91.9216%. This means that 91.9216% of the wage disparity in 2013 stemmed from gender discrimination against women.

The last column of Table 6 shows that discrimination against women is attributable to almost all human capital variables and job characteristics, except for education, marriage, and employment in private enterprises. The price effect of experience is notably high with a value of 0.296109, i.e., it solely accounts for 29.6109% of the total wage disparity. We also notice that not only was women's educational attainment more than men's, but a reverse discrimination against men resulting from education was also observed in 2013 albeit a minimal effect of −0.069118.

Comparing Table 7 to Table 6, we find that the endowment effect falls from 8.0784% to 3.2669% and price effect rises from 91.9216% to 96.7331%, implying the actual level of discrimination against women is higher after controlling for the sample selectivity bias. Total effects in the last column of Table 7 indicates that reverse discrimination against men arising from differences in education falls from

Table 6. Neumark decomposition without sample selectivity controls, 2013.

Independent variables	Endowment Effects	Price Effects 1	Price Effects 2	Total Effects
Education	−0.015071	−0.052547	−0.028499	−0.096118
Experience	0.09077815	0.1599798	0.0453506	0.296109
Experience Squared	−0.0616628	−0.093291	0.0288699	−0.126084
Marriage	−0.0005826	0.0160572	−0.022263	−0.006788
State-Owned	0.02336876	−0.010082	0.0011706	0.014458
Private	−0.0087203	−0.01386	−0.015607	−0.038187
Finance	−0.0036092	0.0046611	0.005764	0.006816
Manufacturing	0.00051749	0.0614823	0.0865578	0.148558
Administrator	−0.0029339	0.0020922	0.0025398	0.001698
East	−0.0027504	0.0099335	0.0062161	0.013399
Central	3.3207E−05	0.012111	0.0137368	0.025881
Total	0.01936733	0.0965366	0.1238367	0.239741
Value % of Total	0.080784	0.919216		1.000000

Table 7. Neumark decomposition with sample selectivity controls, 2013.

Independent variables	Endowment Effects	Price Effects 1	Price Effects 2	Total Effects
Education	−0.0166964	−0.179458	−0.068376	−0.264531
Experience	0.12769071	0.1677394	−0.013647	0.281783
Experience Squared	−0.1069175	−0.111431	0.1005291	−0.117820
Marriage	−0.0018123	0.1145637	0.0192391	0.131991
State-Owned	0.02042008	−0.011859	0.0015069	0.010068
Private	−0.0058612	−0.017287	−0.011495	−0.034644
Finance	−0.0007139	0.0074475	0.0078968	0.014630
Manufacturing	−1.385E−06	0.0942503	0.1100516	0.204301
Administrator	−0.0032745	0.0038154	0.0015921	0.002133
East	−0.0042979	0.0151728	0.004559	0.015434
Central	0.00112589	0.0251753	0.0260951	0.052396
Total	0.009662	0.108128	0.177951	0.295741
Value % of Total	0.032669	0.967331		1.000000

Table 8. Appleton decomposition of the gender wage gap, 2013.

Items	Value of Contribution	Value % of Contribution	Items	Value of Contribution	Value % of Contribution
I	0.009041718	0.023801965	VII	0.052689344	0.138702616
II	0.101191819	0.266383467	I + IV + V	0.008094657	0.021308864
III	0.16653517	0.438397257	II + III + VI + VII	0.37177809	0.978691136
IV	−0.000447699	−0.001178551	II + III	0.26772699	0.704780724
V	−0.000499362	−0.00131455	VI + VII	0.104051101	0.273910412
VI	0.051361757	0.135207797	I + II + III + IV + V + VI + VII	0.379872747	1

Note: The meaning of roman alphabets I, II, III, IV, V, VI and VI are the same as what we defined in Section 3.

−0.096118 to −0.264531, but discrimination against women arising from all the other factors increase.

Table 8 shows the decomposition results by taking into account the impact of employment probability. It shows that the contribution of endowment differentials decreases further from 3.2669% to (I + IV + V =) 2.1308864% and the contribution of discrimination increases from 96.7331% to (II + III + VI + VII =) 97.8691136%, of which 70.4780724% is attributable to wage discrimination and 27.3910412% to employment discrimination against women.

6. Discussion

We list the decomposition results of 1995, 2002, 2007, and 2013 in Tables 9–11, and their visual representations are presented in Figures 1–3. As shown in Table 9 and Figure 1, the contribution of endowment differentials to the wage gap decreased monotonically from 74.2388128% in 1995 to 8.0784494% in 2013. On the other hand, the contribution of discrimination against women increased monotonically from 25.7611872% in 1995 to 91.9215506% in 2013, and the monotonicity remained even when the gender wage gap started to decrease after 2007.

Table 10 and Figure 2 display the Neumark decomposition results with sample selectivity controls. We find that endowment difference alone comprised the gender wage gap in 1995 with a slight reverse discrimination against men, which may be connected to the equal employment policy implemented by the state-owned enterprises and the government's increased emphasis on protection of women's rights. During 1995–2007, the

Table 9. Neumark decomposition without sample selectivity controls, 1995–2013.

Endowment Difference	% of Endowment Difference	Discrimination	% of Discrimination
0.10106069	0.742388128	0.035068492	0.257611872
0.09190604	0.536116931	0.079523054	0.463883069
0.06386896	0.249517879	0.192100502	0.750482121
0.01936733	0.080784494	0.220373317	0.919215506

Table 10. Neumark decomposition with sample selectivity controls, 1995–2013.

Year	Endowment Difference	% of Endowment Difference	Discrimination	% of Discrimination
1995	0.1355067	1.522348588	−0.046495076	−0.522348588
2002	0.0758832	0.394097887	0.116665943	0.605902113
2007	−0.055152	−0.113902215	0.539356927	1.113902215
2013	0.0096615	0.032668859	0.286079105	0.967331141

Table 11. Appleton decomposition,1995–2013.

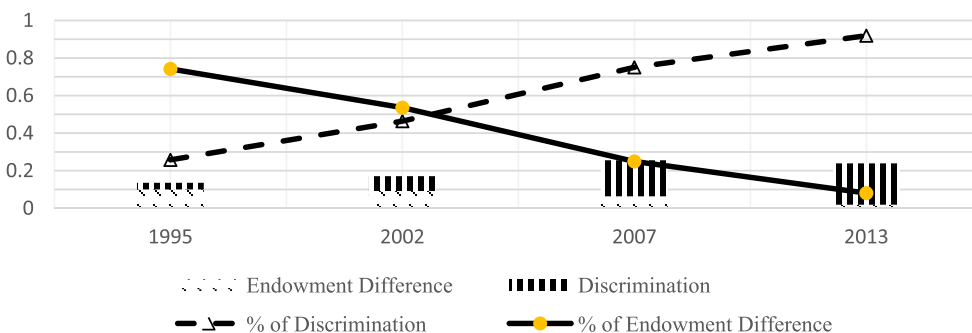| Year	Endowment Difference	% of Endowment Difference	Discrimination	% of Discrimination
1995	0.1510853	1.02806795	−0.004124878	−0.02806795
2002	0.0673195	0.182641377	0.301268782	0.817358623
2007	−0.001062	−0.000965254	1.101044262	1.000965254
2013	0.0080947	0.021308864	0.37177809	0.978691136

Figure 1. Neumark decomposition without sample selectivity controls, 1995–2013.
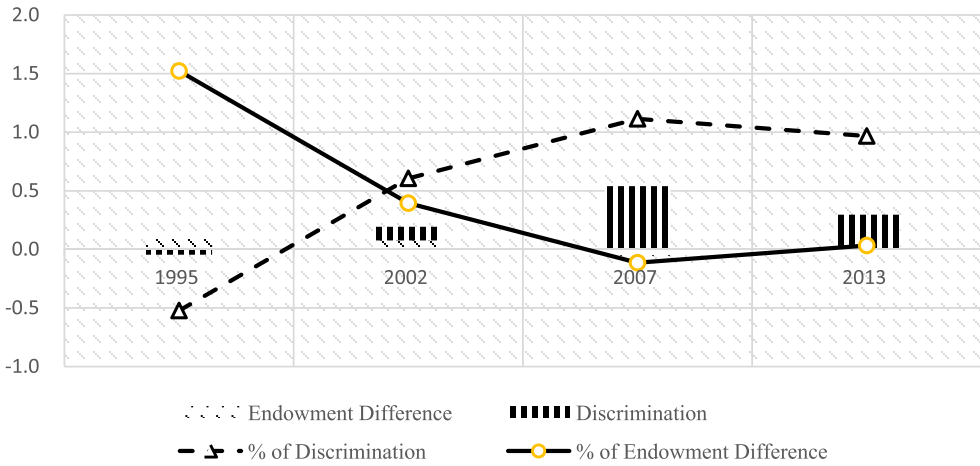
Figure 2. Neumark decomposition with sample selectivity controls, 1995–2013.
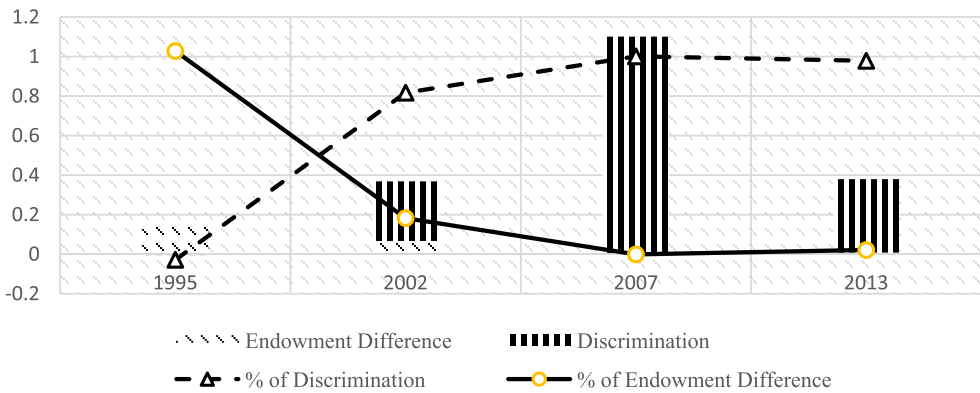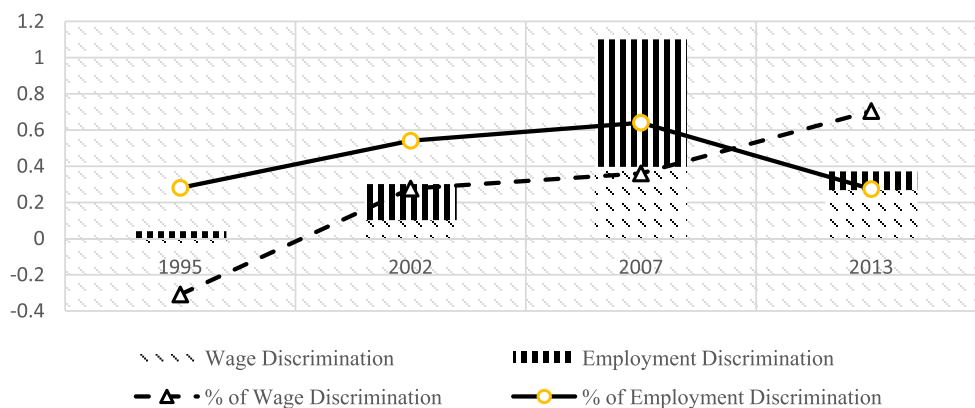

Figure 3. Appleton decomposition, 1995–2013.

component of discrimination steadily increased and the component of endowment differ- ence steadily decreased and became negative in 2007, which indicates that women on the whole have exceeded men in terms of endowment characteristics and that the gender wage gap is completely attributable to discrimination against women. During 2007–2013, the contribution of endowment difference returned to positive (0.0096615), and the con- tribution of discrimination fell marginally but remained as high as 96.7331141%. Generally, discrimination against women has kept the same trend of change with gender wage gap, increasing before 2007 and decreasing thereafter. Appleton decomposition results, as shown in Table 11 and Figure 3, display the same trend of change in both wage gap and discrimination against women as Neumark decomposition.

A further break-down of discrimination, as shown in Table 12 and Figure 4, indi- cates that wage discrimination against men and employment discrimination against women existed simultaneously in 1995, and that the absolute value of wage discrimin- ation against men (–0.0453511) was slightly larger than employment discrimination against women (0.04122619). From 1995 to 2007, employment discrimination and

Table 12. Discrimination decompositon,1995–2013.

Year	Wage Discrimination	% of Wage Discrimination	Employment Discrimination	% of Employment Discrimination
1995	−0.0453511	−0.308593725	0.04122619	0.280525775
2002	0.10192566	0.276529869	0.199343122	0.540828754
2007	0.39638552	0.360356203	0.704658745	0.640609051
2013	0.26772699	0.704780724	0.104051101	0.273910412

Figure 4. Discrimination decomposition, 1995–2013.

wage discrimination against women increased at a constant rate with a higher level of employment discrimination than wage discrimination over those years. These observations are consistent with both common sense and related research suggesting the phenomenon of unequal pay for equal work occurs rarely, and that gender discrimination is most likely a result of industrial and occupational segregation (Li & Xie, 2015). After 2007, the contribution of wage discrimination increased, while the contribution of employment decreased and eventually became lower than that of wage discrimination.

It is worth discussing that if the marketisation reform in China's labour market deprived women of the government's direct protection, incurring an increasingly severe discrimination, what caused a decrease in employment discrimination, which eventually fell lower than wage discrimination against women after 2007? Some factors may be responsible. First, the promulgation and implementation of the Labour Contract Act. In June 2007, the Standing Committee of the National People's Congress passed the New Labour Contract Act of PRC, and in September 2008, the State Council passed the Implementing Regulation on the New Labour Contract Act. Although there are no specific anti-discrimination clauses in ether of the two legislations, both of them explicitly stipulated that employers must consult with the Union and employee representatives on an equal basis when enacting, amending policies regarding rewards, work hours, and other important matters relating to employees' interests. The key point is that the New Labour Contract Act has been well enforced and has induced strong responses from industries,[4] objectively playing a critical role in narrowing gender wage gap and eliminating discrimination against women.

Secondly, there have been changes in the labour market structure. Migrant workers have been the main body of urban China's labour supply[5] until *Min Gong Huang* (severe shortage of migrant workers) emerged in 2004, which spread from coastal regions to inland, from manufacturing to service industries, and from female workers' shortage to overall shortage in 2010 (Li & Tian, 2011). Min Gong Huang signalled that the era of limitless supply of labour in China had come to an end (Wang, Cai, & Gao, 2005). It also meant an increase in the elasticity of labour supply and a decline of the monopoly in urban China's labour market. Both these factors, particularly shortage of supply of female workers, not only put pressure on employers to raise female workers' wages but also significantly weakened employer discrimination (Barth & Dale-Olsen, 2009), thereby narrowing the gender wage gap.

Driven by the optimisation of female workers' endowments, the execution of new labour market legislation, the transformation of labour supply from limitless supply to shortage, as well as the reform of income distribution policies, a long-term trend of convergence in both gender wage gap and discrimination has been forming. 2007 marked the beginning of the advancement of China into a society exhibiting more equity and justice.

7. Conclusion

Using four cross-sectional data from CHIPS 1995, 2002, 2007 and 2013, we explored the changing causes and trends of the gender wage gap and discrimination in urban China's labour market employing Neumark and Appleton decomposition methodology. We found that ① from the mid-1990s to 2007 the gender wage gap and discrimination against women in urban China's labour market witnessed a divergence, and a convergence thereafter; ② the contribution of the endowment difference to gender wage gap is getting smaller and smaller because women have been steadily optimising human capital and job characteristics; and the contribution of discrimination is getting larger and larger, eventually exceeding that of endowment difference and becoming the main contributor to the gender wage gap after 2002; ③ after 2007, both gender wage gap and discrimination against women began to converge, and employment discrimination began to decrease and dropped lower than wage discrimination. The convergence of both gender wage gap and discrimination are results of a combination of factors, including improvement in women's endowments, enactment of the New Labour Contract Act, transition of the labour market structure, and reform of the income distribution policies. We may assert that the convergence is a long term trend, indicating 2007 as the threshold from which China is stepping forward into a more equal and just society.

This study reports the causes and long-term trends of gender wage gap and discrimination in China's urban labour market. We have managed to overcome the flaws of sample selection bias and dual index number problems that existed in previous research studies. However, we have not analysed changing patterns of the wage differentials in different wage distributions, which may be more important to policy makers. The magnitudes, trends, and causes of change in gender wage gap observed using mean decomposition are relatively different from those observed using quantile

decomposition. A quantile analysis would, therefore, be worthwhile. In addition, the effects of industrial segregation, occupational segregation, and regional segregation on gender wage gap would also be invaluable inquiries in this field.

Notes

1. Labor and Social Security Statistical Bulletin 1997–2000, http://www.mohrss.gov.cn/SYrlzyhshbzb/zwgk/szrs/
2. Cai, Zhang, The Green Book on Population and Labor, A Report of China's Population and Labor, No. 17, http://www.ssap.com.cn/c/2016-12-01/1044731.shtml
3. Due to limited space, we have not presented the results of regression for data in 1995, 2002 and 2013 and of their decomposition. Feel free to contact the authors should you have any need.
4. To avoid the potential increase in costs incurred by the New Labor Contract Act, many companies asked to renew the contract with their employees. In the beginning of 2008, 7,000 Huawei employees, including the CEO Ren Zhengfei 'resigned', NetEst, http://news.163.com/07/1027/00/3RP827DF0001124J.html
5. There were 25.278 million migrant workers in 2011 accounting for 70.38% of urban China's labour market, 26.261 million accounting for 70.78% in 2012, 26.894 million accounting for 70.32% in 2013, and 27.395 million accounting for 71.64% in 2014. Statistical Bulletin on Human Resource and Social Security 2011, 2012, 2013, 2014, http://www.mohrss.gov.cn/SYrlzyhshbzb/zwgk/szrs/

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

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