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Labor market segmentation by industry sectors and wage gaps between migrants and local urban residents in urban China

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ABSTRACT

This paper explores the influence of labor market segmentation by industry sectors on the wage gap between rural-to-urban migrants and local urban residents in China in the 2000s. Using Chinese Household Income Project (CHIP) survey data and the results based on the Brown decomposition method, the results indicate that the influence of intra-industrial differentials is greater than the influence of inter-industry differentials in both 2002 and 2013. The influence of the explained component of the intra-industry differentials is larger in both 2002 and 2013, and the influence of the unexplained component of the intra-industrial differentials rises steeply from 2002 to 2013. These results show that the individual characteristic differentials (e.g. human capital) in the same industry sector is the main factor causing the wage gap in both 2002 and 2013, and the problem of discrimination against migrants in the same industry sector became more serious from 2002 to 2013.

1. Introduction

In China, during the economic transition period, two phenomena have attracted attention. First, the Chinese urban market is segmented by the Household Registration System (the “*Hukou System*”). The *Hukou System* influences the opportunity of entry to various sectors (e.g. public sector, vs. private sector; and monopolies vs. competitive industries), wage level, and the social security system, creating discrimination against migrants in employment and wages (Ma, 2011a, 2016a; Meng & Zhang, 2001; Song & Appleton, 2006; Wang, 2003, 2005; Zhang, 2004; Zhang, Li, Darity, & Sharp, 2016). From the 1980s the Chinese government has deregulated the *Hukou System* and promoted reform during the 2000s. The number of migrants increased dramatically to around 160 million during the 2000s based on 2000 and 2010 population census. Currently the Chinese government is implementing a Rural-urban Integration Registration System (“*Chengxiang Yitihua Hukou Zhidu*”). It is expected that deregulation of the *Hukou System* may reduce discrimination against the migrants in the labor market.

Second, the wage gap between the monopolistic industry sector (e.g. production and supply of electricity, heat, gas and water industry; transport, storage and post industry; financial intermediation industry; education, and the health service industry) and the competitive industry sector (e.g. manufacturing, construction, retail, and wholesale industries) has widened since the 1990s (Cai, 1996; Luo & Li, 2007; Demurger, Fournier, Li, & Wei, 2007; Jin & Cui, 2008; Ma, 2011b, 2014). The main reason for these phenomena can be explained as follows. The economic system reform pattern is progressive. The Chinese government promoted the development of private-owned enterprises (FOEs) and foreign investment enterprises (FIEs) in the competitive industries since the 1980s. With the development of the private sector, the government prompted state-owned enterprise (SOEs) reform from the end of the 1990s. However, most large SOEs in the monopolistic industries were still managed by the government, and employment and wage determination were controlled by the government during the 2000s. After the global financial crisis (economic downturn precipitated

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by the Lehman Brothers' bankruptcy in 2007), named the Roman shock, the Chinese government invested CNY 4 trillion to stimulate economic recovery, and the main beneficiaries are the SOEs in the monopolistic industries. In contrast, FOEs and FIEs in the competitive industries operate by the market mechanism in which the employment and wage levels are determined by labor productivity and the labor supply and demand. Because government support differs, and the employment and wage determinate mechanisms differ in monopolies and competitive industries, it can be said that the Chinese urban labor market is segmented by industry sectors. Cai (1996), Luo and Li (2007), Demurger et al. (2007), Jin and Cui (2008), Ma (2011b, 2014) pointed out that the industrial wage disparity increased from the 1990s. This indicates that the problem of labor market segmentation by monopolistic and competitive industries become serious during the 2000s.

To consider the determinants of the wage gap between migrants and local urban residents, it can be thought that labor market segmentation by industry sectors may affect the wage gap. For example, if there is discrimination against migrants when they enter the monopolistic industries, which means the opportunity of entry to the monopolistic industry sector differs for migrants and local urban residents, the proportion of workers in the various industry sectors may differ between these two groups. Roberts (2001), Song and Appleton (2006) indicate that most migrants are concentrated in competitive industries, whereas most local urban residents work in monopolies. Because the industrial wage disparity remains, the difference of industry sector distribution proportions between these two groups may create a wage gap. In addition, the discriminations against migrants may remain in the same industry sector, which may also create a wage gap. Thus to investigate the determinants of the wage gap between migrants and local urban residents, the influence of industrial factors should be examined.

The main contributions of this study are as follows: first, for the issue of the wage gap between the migrants and local urban residents, most previous sectors focus on the influence of human capital differentials and discrimination; the previous studies which considered the influence of sector segmentation on wage gap only focus on the occupational segregation (Li & Gu, 2011; Meng & Zhang, 2001; Wang & Zhang, 2014), and ownership types (Demurger, Li, & Yang, 2012; Wang, 2005). Even though it is predicted that labor market segmentation by the monopolistic and competitive industries may affect the wage gap, there is no empirical study to investigate how the difference between the migrants and local urban residents in the opportunity to be employed in various industry sectors affects the wage gap, and how the discrimination against migrant groups in the same industry sector affects the wage gap simultaneously. This study provides evidence to develop the discussion about this neglected area. Second, although the influence of marketization reform on the wage gaps is considered in previous studies (e.g. Meng & Zhang, 2001; Xing, 2008; Xing & Luo, 2009 and Ye, Li, & Luo, 2011), this study provides the evidence to explore the issue from a new perspective: that of considering the influence on the wage gap of labor market segmentation by the monopolistic and competitive industries. Third, this study uses two periods of survey data from the Chinese Household Income Project (CHIP) conducted in 2003 and 2014 (CHIP2002 and CHIP2013), to investigate the change of the influence of industrial factors on the wage gap during the 2000s. The latest survey data of CHIP2013 provides the newest information about the issue.

This paper is structured as follows. Section 2 gives the background to the empirical study. It introduces the policy change for monopolistic and competitive industries, and the discrimination against the migrants by the *Hukou* System during the economic transition period, particularly in the 2000s. Section 3 summarizes the theory and hypotheses about discrimination and empirical studies relating to China. Section 4 describes the analytic methods, including an introduction to data and models. Section 5 discusses the description analysis results, and Section 6 introduces the quantitative analysis results. The last section summarizes the main conclusions.

2. Monopolistic industries and discrimination against migrants in China

The policy change for monopolistic industry and discrimination against migrants by the Chinese *Hukou* System during the economic transition periods are reviewed in order to develop the background of this empirical study.

2.1. Economic transition and monopolistic Industries in China

In the period of planned economy (1949–1977) all organizations/enterprises in various industries in the urban regions were state-owned enterprises (SOEs) or collectively owned enterprises (COEs). The employment and wage levels were managed by the government and there were no competitive industries during the period.

Since the 1980s, the Chinese government performed the economic system reform to permit the existence of the privately owned enterprises (POEs) and foreign investment enterprises (FIEs).

In the end of the 1990s, the government promoted the SOEs reform, a part of the middle- and small SOEs and most COEs transformed to become POEs ("*Zhua Da Fang Xiao*"), whereas the large SOEs are still controlled by the government.

Since the 2000s the Chinese government implemented policies to encourage large SOEs to participate in global competition and to establish overseas enterprises ("*Zouchuqu*") in order to enlarge the economic and political influence in the world. Consequently the government influence on the monopolistic industries increased since the end of the 1990s. For example, in 1999 at the Communist Party Conference the government made efforts to support those industries which affect the national safety, monopolistic industries, and public sectors which provide the public goods and services, and important industries—they are machinery industry, electronics industry, petrochemical industry, automotive industry, and construction, and building materials industries. In 2006, the government promulgated the policy to emphasize that central government will focus on those sectors which influence the national safety and national economy greatly, and provide more public finance investment to these sectors. After the global financial crisis in 2007, the Chinese government invested 400 billion Yuan to stimulate economic recovery. The main beneficiaries of the policy were the large

SOEs, most of which are in the monopolistic industries. In 2012, at the 18th Communist Party Conference, the government declared that the central government will provide more public finance investment to important industries which affect national safety and the national economy. Moreover, the *Xijinpong* government are enforcing the industry upgradation and promoting the “One Belt One Road” (“*Yidaiyilu*”)¹ policy, the implementation of these new policies has caused the influence of the Chinese government on the monopolies to increase. It is predicted that the problem of labor market segmentation by monopolies and competitive industries will become even more serious during the 2000s. According to neoclassic economics a monopolistic industry can get monopolistic rent to increase the production price and get more profit, and consequently the wage level for monopolistic industry may be set higher than for a competitive industry. The wage gap between migrants and local urban residents will be widened when a migrant cannot get a job in a monopolistic industry due to discrimination against migrants caused by the *Hukou* System.

2.2. Segmentation by industry sectors and discrimination against migrants based on the *Hukou* System

There follows a review the labor market segmentation by industry sectors and discrimination against migrants based on the *Hukou* system. In the period of planned economy (from 1949 to 1977), in order to promote the development of the heavy manufacturing industry (iron and steel manufacturing industry), the Regulation of Household Registration System (*Hukou* System) was implemented in 1958, the migration from the rural region to the urban region was inhabited based on the regulations of the *Hukou* system.

From 1984 to 1988, the *Hukou* System was deregulated, and migration from the rural regions to the urban regions was permitted. However, in the 1980s, most firms and organizations were in the public sector or monopolistic industries. The employment and wage level were managed by the government, therefore most migrants could not find jobs in monopolistic industries, the migrants had to work in the informal sector (e.g. self-employed sector, private firms) to live in the urban region (Ma, 2016b; Meng & Zhang, 2001; Song & Appleton, 2006; Wang, 2003, 2005; Zhang, 2004).

The *Hukou* System was further deregulated from 1992 to 1994, but during the period from 1995 to 2000, because with the adjustment of employment in the SOEs, the unemployment rate of local urban residents increased significantly and the migrant group became a competitor of local urban residents, the migration from the rural regions to the urban regions was again strictly controlled by the government. Most migrants could only be employed in a few kinds of job designated by the local governments. These designated jobs were those the local urban residents disliked (Song, Huang, & Liu, 2006).

During the 2000s, with membership of the WTO from 2001, the number of firms in competitive industries, such as privately-owned enterprises (POEs) and foreign investment enterprises (FIEs) in the manufacturing industry sector increased greatly. Based on the market mechanism, POEs and FIEs in competitive industries strove to reduce labor costs to gain the maximum profit. Because migrants are surplus labor in the rural regions, the wage level of migrants may be set at a low level almost equal to the subsistence level (Lewis, 1954). Thus in the competitive industries, the demand for labor is greater for migrants than for local urban residents. During the 2000s due to *Hukou* System deregulation, the number of migrant workers increased dramatically in the urban regions.² However, the discriminations against migrants by a set of systems,³ which are based on the *Hukou* System still remains and the inequality between migrants and local urban residents is a serious social problem. To address this the government promoted the deregulation of the other systems based on the *Hukou* System during the 2000s. Examples of these reforms are: a set of policies to permit migrant children to enter urban public schools; the implementation of a social security policy for migrants, and the establishment of an Urban-rural Integration Registration System in some regions (e.g. Chongqing, Guangzhou, Beijing) (Song, 2016; Wei, 2016). However, as Cai and Bai (2006), Li (2013) point out, during the 2000s, the differences between migrants and local urban residents access to the housing supply, education and health care services, social security systems, and the differences for the employment opportunity and wage have not disappeared. Zhang (2004), Li and Gu (2011), Ma (2011b), Zhang et al. (2016) indicate that there remains discrimination against migrants when they enter the monopolistic industry sector, and this discrimination based on *Hukou* System makes it difficult for migrant workers to find jobs in most monopolistic industries.⁴

3. Literature review

3.1. The channels of the influence of industrial factors on the wage gap between migrants and local urban residents

What determines the wage gap between migrants and local urban residents? The hypotheses and discrimination theories from the economic perspective are summarized as follows.

Based on the employer discrimination hypothesis (Becker, 1957), discrimination against migrants might be shown by employers,

¹ The Chinese government promoted the “One Belt One Road” policy since 2013. It includes many countries from Singapore to Syria, most of which are near the historic trade route known as the Silk Road. The Chinese government encourages active participation in overseas infrastructure investment and construction by exporting mechanical equipment.

² For example, the number of migrants increased from 28.25 million in 2000 to 140.41 million in 2008, and to 163.36 million in 2012 (2000 Population census; Household survey office, NBS, 2013).

³ The regulations based on *Hukou* System included house supply, education and health care service, employment and wage, public/social security systems which are available for local urban residents.

⁴ Even though Zhang (2004), Li and Gu (2011), Ma (2011b), Zhang et al. (2016) use a logit model to investigate the probability to enter the monopolistic sector and industry sector distributions, they point out that there is opportunity discrimination between migrants and local urban residents when they enter the monopolistic sector, these studies do not use decomposition analysis to analyze the intra- industry and inter-industry difference in the wage gap.

customers, and colleagues: this discrimination causes the wage gap. As it is pointed out in Becker (1957), under a perfect competitive market, the discrimination should disappear in the long-term because the discrimination should reduce the firm's profit. In China, compared with the monopolistic industry sector in which the proportion of the SOEs and public organizations are greater, the firms in the competitive industry sector in which the proportion of the privately-owned enterprises (POEs) and foreign investment enterprises (FIEs) are greater, face a competitive market in which they strive to maximize their profit. It is thought that market competition should reduce discrimination against migrants in the long-term. Thus the wage gaps between migrants and local urban residents may be smaller in the competitive industry sector than the wage gap in the monopolistic industry sector. In the monopoly industry sector, the government determines the employment plan, therefore discrimination may exist when a migrant enters the monopolistic industry sector via the *Hukou* System. There may exist a difference of opportunity to enter the monopolistic industry sector.

In human capital theory (Becker, 1964; Mincer, 1974), it is pointed out that in the perfect competitive labor market, the individual wage level is determined by a worker's labor productivity; the labor productivity is in relation to a worker's human capital factor. Thus a worker with a higher level of human capital (higher education level, or more years of experience) should gain a higher wage. For example, when the education level is lower for the migrant group than for the local urban resident group, a wage gap between these two groups may appear in the same industry sector. When highly skilled workers with higher education are needed in the monopolistic industry sector, because most the education/skill level is low for the migrant group than that for the urban resident group, the differentials of the chance of entry to the monopolistic industry sector in which the wage level is higher may arise. This will affect the wage gap between migrants and local urban residents.

In addition, based on the crowded hypothesis (Bergmann, 1974), the proportion in the migrant-dominated industry sectors (competitive industries-manufacturing, construction, retail/wholesale industries) is greater for the migrant group. When the wage level in the migrant-dominated industry sector is lower than in the local urban resident-dominated industry sector (monopolistic industries-financial industry, management of water conservancy and environment industry, transport, storage and post industry), the wage gap may be created.

Based on these theories and hypotheses, and the changes in government policies for the monopolistic industries during the 2000s previously described in Section 2, the mechanism on the influences of industrial factors on wage gaps can be considered as follows.

First, because regular worker employment in the monopolistic industries is still managed by the government, and the influence of the government on large SOEs increased, the opportunity of entry to the monopolistic industries may differ between migrants and local urban residents. This may cause differences in industry sector distribution between these two groups. The wage level in the competitive industries is lower than that in the monopolistic industries⁵ because there remains an industrial wage disparity. If employment opportunities in the monopolistic industry sector are fewer for the migrants than for the local urban residents, the wage gap between migrants and local urban residents may grow. The wage gap caused by the differences in the opportunity of entry to various industry sectors is designated as an *inter-industry sector differential*.

Second, in a given industry sector, migrants may earn less than local urban residents. This is designated as an *intra-industry sector differential*.

Third, in both inter-industry sector differential and intra-industry sector differential, based on the ideas from Blinder (1973) and Oaxaca (1973), two factors may cause wage gaps—they are the explained differentials (differentials based on individual characteristics, including the human capital), and the unexplained differentials (discrimination against migrants). For example, in a given sector (a case of *intra-industry sector differential*), based on the employer discrimination hypothesis (Becker, 1957), when an employer prefers the local urban residents, which may be caused by the influence of the employment system in the planned economy period, the discrimination against migrants may be created. Therefore even though the human capital of the migrants are constant with the local urban residents, a wage gap may appear (a case of *unexplained component in the intra-industry sector differential*). On the other hand, when the labor productivity (e.g. education or skill level) is lower for migrants than that for local urban residents, even though there is no discrimination against migrants, due to the market mechanism, the migrants may earn less than the local urban residents (a case of *explained component in the intra-industry sector differential*).

Thus, the influence of segmentation by industry sectors on wage gap can be divided into four factors: (i) the explained component in intra-industry sector differentials, (ii) the unexplained component in intra-industry sector differentials, (iii) the explained component in inter-industry sector differentials, and (iv) the unexplained component in inter-industry sector differentials. It is thought the four factors may affect the wage gap. Even though it can be thought when monopolies are strengthened by government policies during the 2000s, the discrimination against migrants might increase to cause an increase in the influence of the unexplained component from 2002 to 2013. We cannot predict the influence of these four industrial factors quantitatively: it needs to take an empirical study to provide the evidences.

3.2. Summary of empirical studies on the wage gap between migrants and local urban residents

In previous empirical studies there are three main perspective approaches to analyze the wage gap between migrants and local urban residents in China.

First, based on the Oaxaca and Blinder model (Blinder, 1973; Oaxaca, 1973), the decomposition of mean values is employed.

⁵ For empirical studies on the industrial wage disparity, please refer to Cai (1996), Luo and Li (2007), Demurger et al. (2007), Jin and Cui (2008), Ma, 2014. They indicate that the wage level in the competitive industries is lower than that in the monopolistic industries when factors (e.g. education attainment, experience years) which can affect the wage are controlled.

Although previous studies pointed out that the explained differentials (e.g. education attainment differentials) between these two groups and the unexplained differentials (e.g. the discrimination against migrants) affect the wage gap, the estimated values of the unexplained differentials are not consistent in these studies. For example, some studies denoted that the unexplained differentials are greater than the explained differentials, thus the discrimination is the main factor causing the wage gaps; concretely, the estimated values of the unexplained differentials are 24.88–94.11% in 1999–2000 (Maurer-Fazio & Dinh, 2004), 60% in 2002 (Deng, 2007), 55.2% in 2003–2004 (Xie & Yao, 2006), 54.25% in 2004–2011 (Chang & Zhao, 2016). Whereas some studies showed the unexplained differentials are smaller than the explained differentials; it is pointed out that the estimated values of the unexplained differentials are 38.10% in 1993–2000 (Chang & Zhao, 2016), 27% in 2002 (Guo & Zhang, 2011), 36.9% in 2002 (Ma, 2016a), 26.3% in 2002 and 42.3% in 2007 (Zhu, 2016), 4% in 2005 (Xing & Luo, 2009), 10% in 2005 (Lee, 2012; Xing, 2008), 27.11% in 2006 (Meng & Wu, 2014), 36% in 2007 (Zhang, Li, Darity, & Sharpe, 2014). Demurger, Gurgand, Li, and Yue (2009) showed that the population effect (e.g. education) is 138% (education 113%), which is greatest factor to contribute to the wage gap in 2002. Messinis (2013) pointed out the explained differentials, especially the education gaps between migrants and local urban residents is the main factor causing the wage gap, and when the endogeneity problem of education is addressed, the wage gap completely disappears. Ma (2016a) also points out the explained differentials is 125.4–130% in 2013, the results are similar with Demurger et al. (2009) and Messinis (2013). To summary, the explained differentials seem like the main factor causing the wage gap, and its influence increases during the economic transition period.

Second, based on the wage distribution decomposition method (e.g. Juhn, Murphy, & Pierce, 1993, Fortin & Lemieux, 1998, Machado & Mata, 2005, Melly, 2006) models, Deng (2007), Xing and Luo (2009), Yu and Chen (2012), Zhu (2016) analyzed the wage gap by wage percentiles. Deng (2007) showed that the influence of the unexplained differentials in 2002 is greater for the low and middle-wage groups, whereas it is smaller for high-wage groups. Xing and Luo (2009) pointed out the explained differentials are greater (94%) than the unexplained differentials, and the unexplained differentials (skill price effect) are higher for the low-wage group than for the high and middle-wage group. Yu and Chen (2012) showed that the influence of the unexplained differentials is greater for middle-wage groups than for low and high-wage groups in 1997, 2004, and 2009, but it is greater for the low-wage group than for middle and high-wage groups in 1994; the effect is mostly similar between the low-, middle- and high-wage groups in 2000. Zhu (2016) showed that the unexplained differentials are higher for the high-wage groups than for low and middle-wage groups in both 2002 and 2007. To summary, these studies estimate the values of the unexplained and explained differentials by wage percentiles, and indicate that the influence of these factors differs by various percentile wages: but these estimated results are not consistent, which is cause by the difference of analyzed period, survey data and variables utilized in models.

Third, some studies analyze the influence of labor market segmentation by various sectors on the wage gap based on the Brown model (Brown, Moon, & Zoloth, 1980). For example, Meng and Zhang (2001) analyzed occupational segregation (white collar, wholesale and retail trade, services, laborers) and the wage gap between migrants and local urban residents. They found that the value of discrimination in the same occupation (the unexplained component in the intra-occupation differential) is 105.74% which is the main factor underlying the wage gap, and the total value of the unexplained differentials is 110.59% which is significantly higher than that of explained differentials in 1995–1996. Wang (2005) analyzed sector segmentation (self-employed, workers in the public sector, workers in the non-public sector, manager and technician in the non-public sector) on wage gaps, she found that the value of the explained components of inter-sector (31.80%) is greatest, and the total value of the explained differentials is 57.12% which is higher than that of explained differentials in 2005. Wu and Zhang (2014) analyzed the influence of occupational segregation (38 kinds of occupation classification), and found the value of the explained differentials of inter-sector (130.66%) is greatest, and the total value of the explained differentials is 175.64% which is higher than that of explained differentials in 2005. Zhang and Guo (2014) analyzed the influence of occupational segregation (low-, middle-, and high level occupations) on wage gap, and pointed out the influences of the factors on wage gap differ by various industry sectors. For example, the total value of the unexplained differentials is greatest in the wholesale and retail trade industry (533.093%) and is smallest in the post industry (– 1263.714%) in 2012. However, the previous studies did not sufficiently analyze how the wage gap is influenced by labor market segmentation in various industry sectors.

This study focuses on the influence of industrial factors on the wage gap between migrants and local urban residents. Using two period survey data and the Brown model, it investigates three questions. First, how does discrimination when migrants enter an industry sector affect the wage gap (entry opportunity discrimination)? When human capital factors are constant, how does the discrimination against a migrant worker in the same industry sector (work place discrimination) affect the wage gap? Second, how do the overall explained differentials (e.g. the differentials of individual characteristics, including human capital) in the same industry sector (intra-industry sector) or between the various industry sectors (inter-industry sector) affect the wage gap? Third, does the influence of these discriminations change during the 2000s? It is believed this is the first study to utilize the Brown decomposition model for the estimations required to answer these questions. It is to be hoped these results provide new evidence for the issue on the determinants of the wage gap between migrants and local urban residents from the industrial segmentation perspective, it enables us to better understand the influence of government and labor market segmentation on the wage gap.

4. Methodology and data

4.1. Model

To estimate the consistency of other factors like human capital when examining how the segmentation by industry sectors affects

the wage levels, the wage functions are calculated. The OLS model is utilized; it is expressed as Eq. (1.1).⁶

$$\ln W_i = \beta H_i + \beta I_{Ind_i} + u_i \tag{1.1}$$

In Eq. (1.1), i represents the individual (a migrant or a local urban resident), $\ln W$ is the logarithm of the average wage, H represents factors (e.g. education, experience years) which affect wage, Ind represents industry sector dummy variables, β is estimated coefficient, u is a random error item. When β is statistically significant, it indicates that when the other factors (e.g. human capital) are held constant, there are wage gaps between various industry sectors.

To consider the selection bias problem (a worker can choose to enter an industry sector) left in OLS model, the Maddala model (Maddala, 1983) is used. Using the estimated results of the distribution function and the density function by the multinomial probit regression model (the dependent variable is $\Pr(Y_i = 1)$ which indicates probability of the choice to entry to an industry sector), selectivity items ($\lambda = \psi(\cdot)/\Phi(\cdot)$) for each industry sector are calculated. The multinomial probit regression model includes the identification variables.⁷ The corrected wage function expressed by Eq. (1.2) is estimated using these selectivity items.

$$\ln W_i = \beta H_i + \beta I_{Ind_i} + \beta \lambda_i + u_i \tag{1.2}$$

Then, to estimate how the industry sector segmentations affect the wage gap between migrants and local urban residents, the Brown model is used (Brown et al., 1980). It is expressed as follows.

First, the probabilities of entry to industries are estimated based on a multinomial logistic model, shown as Eq. (2.1).

$$P_{ik} = \text{prob.} (Y_{ik} = \text{industry}_{ik}) = \exp^{X_{ik} \gamma} / \sum \exp^{X_{ik} \gamma} \tag{2.1}$$

$i=1, \dots, N$ individuals

$k=1, \dots, h, \dots, K$ industries

In Eq. (2.1), $P_{ik} = \text{prob} (Y_{ik} = \text{industry}_{ik})$ represents the individual i 's probability of entry to industry k , X represents factors (e.g. education, experience years) which affect the selection of entry to an industry. Based on the estimated results by Eq. (2.1), the migrants' imputed industrial distributions (P^{rm*}) are calculated - P^{rm*} are calculated on an assumption condition that there don't exist discriminations when migrants entrance to these industry sectors.

Second, the wage functions by the industry categories are estimated. Wage functions by k kinds of industry categories are expressed by Eq. (2.2). X represents factors which affect wage. To solve the selection bias problem (a worker can choose to enter an industry sector), selectivity items ($\lambda = \psi(\cdot)/\Phi(\cdot)$) for each industry sectors are calculated and included in X .

$$\ln W_{ik} = \alpha_k + \beta_{ik} X_{ik} + u_{ik} \tag{2.2}$$

Third, the estimated results based on Eq. (2.1), Eq. (2.2), and the mean values of variables are used to decompose the influence of industry sector segmentation on the wage gap into four categories. The decompositions are shown in Eq. (2.3).

$$\begin{aligned} \ln \bar{W}_u - \ln \bar{W}_m &= \sum P_k^{rm} \hat{\beta}_k^u (\bar{X}_k^u - \bar{X}_k^{rm}) \\ \text{(A)} & \\ &+ \sum P_k^{rm} (\hat{\alpha}_k^u - \hat{\alpha}_k^{rm}) + \sum P_k^{rm} \bar{X}_k^{rm} (\hat{\beta}_k^u - \hat{\beta}_k^{rm}) \\ \text{(B)} & \\ &+ \sum \bar{W}_k^u (P_k^u - P_k^{rm}) \\ \text{(C)} & \\ &+ \sum \bar{W}_k^u (P_k^u - P_k^{rm}) \\ \text{(D)} & \end{aligned} \tag{2.3}$$

In Eq. (2.3), P_k^u, P_k^{rm} represent the actual industry distributions of migrants and local urban residents, $\hat{\beta}_k^u, \hat{\beta}_k^{rm}$ are the imputed industry distributions of migrants, $\bar{X}_k^u, \bar{X}_k^{rm}$

represent mean values of variables, $\hat{\beta}_k^u, \hat{\beta}_k^{rm}$ are the parameters estimated based on wage functions by industry categories.

To find the econometric meanings of decomposition results by Eq. (2.3) three steps are taken. First, $\sum P_k^{rm} \hat{\beta}_k^u (\bar{X}_k^u - \bar{X}_k^{rm})$ (A) represents the individual characteristics differentials in the intra-industry sector differentials (explained component in the intra-industry sector differentials), the total value of $\sum P_k^{rm} (\hat{\alpha}_k^u - \hat{\alpha}_k^{rm}) + \sum P_k^{rm} \bar{X}_k^{rm} (\hat{\beta}_k^u - \hat{\beta}_k^{rm})$ (B) represents the unexplained component (e.g. discrimination about the migrants in the same industry) in the intra-industry sector differentials, $\sum \bar{W}_k^u (P_k^u - P_k^{rm})$ (C) represents the individual characteristics differentials in the inter-industry sector differentials (explained component in the inter-industry sector

⁶ In order to simplify the expression of equations all constant items are omitted

⁷ The married status, age, age squared are used as identification variables in this study.

differentials), $\sum \bar{W}_k^u (P_k^{\wedge m} - P_k^m)$ (D) represents the unexplained component (e.g. the discriminations against the migrants when they entrance to an industry sector) in the inter-industry sector differentials.

Second, the total value of A and C represents the overall explained differentials caused by the differentials of individual characteristics when the migrants enter an industry sector, or when the migrants work together with local urban residents in the same industry; the total value of B and D represents the overall unexplained differential, both of these caused by the discrimination when the migrants enter an industry sector, or when the migrants work together with local urban residents in the same industry.

Third, the total value of A and B represents the overall intra-industry sector differentials caused by discrimination against migrants and the differentials of individual characteristics including human capital in the same industry sector; the total value of C and D represents the overall inter-industry sector differentials caused by the discrimination against migrants and the differentials of individual characteristics when migrants enter an industry sector.

4.2. Data

Two period survey data from the Chinese Household Income Project (CHIP) conducted in 2002 and 2014 (CHIP2002, CHIP2013) are used for the analysis. These data are gained from the CHIP conducted by Economic Institute of Chinese Academy of Social Sciences (CASS) and Beijing Normal University in 2003 and 2014, including information about the individual characteristic factors, industries and wages of migrants⁸ and local urban residents. Because there are design similarities of the data in the questionnaire, the same information for analysis for two periods can be utilized. To make comparisons in the two periods, the regions (provinces or cities) covered in both surveys, including Beijing, Shanxi, Liaoning, Jiangsu, Anhui, Guangdong, Henan, Hubei, Sichuan, Yunnan, and Gansu are selected.

The analytic objects are workers, excluding the unemployed. In considering the retirement system implemented in the public sector, the SOEs and the government organizations. To reduce the effect of the retirement system on the analysis result the analytic objects are limited to the age of 16 to 60. No answer samples, abnormal value samples,⁹ and the missing value samples are deleted.

To see the dependent variables setting, first, in the probability function of entry to industries, the depended variable is a category variable. To maintain the analysis samples by each industry category and consider the feature of the industry distributions of migrants, the industrial categories in the CHIPs are reclassified.¹⁰ Five kinds of industries, construction, manufacturing, retail and wholesale industries, service, and other industries, are used to construct the category variables.

Second, in the wage function, the dependent variable is the logarithm of the wage rate. The wage rates are calculated based on total wage and work hours. The total wage in is the total value of the basic wage, bonus, cash subsidy, and no cash subsidy which is calculated based on the market price, excluding layoff living assistance, minimum income assistance, and living assistance by firms, income by asset and financials, security transfer income. We use the CPI in 2002 as the standard, and adjust the nominal wage in 2013. Because the questionnaire items on wage are different for migrants and local urban residents the information about yearly wage for local urban residents and monthly wage for migrants can be obtained. To unify the dependent variable, the wage rate (hourly wage) is calculated using yearly work hours for local urban residents and monthly work hours for migrants. Work hours yearly for local urban residents are calculated by “work hours daily \times work days monthly \times work month yearly”, and work hours monthly for migrants are calculated by “work hours daily \times work days weekly \times 4”. Wage rates are calculated by total wage divided by appropriate work hours.

The independent variables are the variables likely to affect the wage level and the probability of entry to industry: they are conducted as the follows. First, education (primary school or below, junior high school, senior high school/vocational school, college and above), experience years,¹¹ age, health status (very good, good, fair, bad) are conducted as the index of human capital. It is though that these factors might affect the wage level and the probability of entry to industries.

Second, it is pointed out that there are wage gaps between public and private sectors.¹² Public sector dummy variable and the private sector dummy variable are employed to control the influence of ownership types on the wage gap. Concretely, the public sector includes state-owned enterprises (SOEs) and government organizations. The private sector composes of collectively owned enterprises (COEs) and foreign/private owned enterprises, self-employed workers, and other ownership sectors.

Third, it is pointed out that special political membership may affect the probability of entry to industry and the wage levels.¹³ A party membership dummy is used in the analysis.

Fourth, in the previous studies, it is pointed out that there is a gender wage gap in Chinese labor market.¹⁴ To control the

⁸ A sampling bias problem may exist in the migrant survey. In the survey of CHIP2002, CHIP2013, only migrants officially registered and who were living in the urban area in the survey year can become the random selection sampling objectives, therefore most migrants who live in apartments nearby the workplace provided by firms may not be surveyed (Li, Sicular, & Gustafsson, 2008)

⁹ Variable values are in the range of “mean value \pm three times S.D.” is defined as abnormal value here.

¹⁰ The numbers of industry categories are sixteen in the survey for local urban residents, and twenty- five in the survey for migrants in CHIPs.

¹¹ Experience years = age-schooling year-6.

¹² For the empirical studies on the wage gap between public and private sectors in China, please refer to Chen, Demurger, and Fournier (2005), Zhang and Xue (2008), Ye et al. (2011), Demurger et al. (2012), Zhang (2012), and Ma (2014, 2015, 2016c).

¹³ Gustafsson and Li (2000), Wu and Xie (2003), Knight and Yueh (2008), and Appleton, Knight, Song, and Xia (2009) found that there remains Communist Party member wage premium in China.

¹⁴ Gustafsson and Li (2000), Liu, Meng, and Zhang (2000), Maurer-Fazio and Hughes (2002), Demurger et al. (2007), Ma (2007, 2009), Demurger et al. (2007), Guo and Zhang (2010), Li and Yang (2010), Li, Song, and Liu (2011), Ma, Gu, and Li (2013) analyze the gender wage gaps based on the decomposition methods and found that the discrimination against women is the main factor in China.

influence of gender disparity on wage, the gender dummy variable is constructed. Moreover, considering family status and race¹⁵ may affect the probability of entry to industry or wage levels, the married, and Han majority dummy variables are also used.

Fifth, because of regional disparity for economic development levels, and because the labor markets different between the regions, East, Central, and West regions dummy variables are used to control these influences.¹⁶

5. Descriptive statistics results

5.1. Individual characteristic differentials by migrants and local urban residents, and by industry categories

The mean values of variables by migrants and local urban residents, and by industry categories, are shown in Table 1. It is observed that the individual characteristics, and industry sector distributions differ by migrants and local urban residents as the following.

First, the mean age is greater for local urban residents than for migrants, and that years of experience are greater for local urban residents than for migrants, in both 2002 and 2013. These results are consistent with the phenomenon that most of the younger labor force with rural registration is moving to and working in urban regions.

Second, although in 2002 and 2013 the proportion of workers with higher education (such as senior high school and college/university) is smaller for the migrants group, the proportion of migrant workers that has graduated from senior high school rises from 17.7% (2002) to 22.4% (2013), the proportion of workers who have graduated from college or university rises from 2.3% (2002) to 12.0% (2013). These results show that education attainment gaps between migrants and local urban residents have changed greatly from 2002 to 2013.

Third, in both 2002 and 2013, the proportion of communist party members is greater for the local urban resident group (29.3% in 2002, 20.8% in 2013) than for the migrant group (3.3% in 2002, 4.3% in 2013).

Fourth, in both 2002 and 2013, most local urban residents work in the public sector (66.7% in 2002, 40.7% in 2013), whereas the proportion of self-employed workers is greater for migrants (73.0% in 2002, 44.4% in 2013). The proportion of workers in the private sector rises greatly for both migrant and local urban resident groups. For example, the proportion rises from 13.8% (2002) to 32.3% (2013) for local urban residents, and it rises from 11.6% (2002) to 39.1% (2013) for migrants. These results reveal that along with the decrease of worker share in the public sector, the private sector absorbed more workers (both migrants and local urban residents) from 2002 to 2013.

Fifth, individual characteristics differ in various industries. For example, in 2013, the proportion of workers who graduated from college/university is greatest in the service industry (32.9%) and smallest in the retail and wholesale industry (19.6%) among local urban resident groups, while for migrant groups, the proportion is greatest in the service industry (14.4%) and smallest in the construction industry (6.4%).

It is predicted that the differentials of individual characteristics may affect the opportunity of entry to an industry sector, and industrial wage disparities.

5.2. The proportions in various industry sectors

How are the opportunities of entry to industry sectors for migrants and local urban residents different? The resulting proportions for self-selection or choice, in various industry sectors are shown in Table 2.

For the construction and retail/wholesale industries, in both 2002 and 2013, the proportion are greater for migrants than for local urban residents. For example, in 2013, the proportion in construction is 9.0% for migrants, which is greater than that for local urban residents (4.9%). The difference of the proportions in the construction and retail/wholesale industries between migrants and local urban residents can be explained as follows. The construction industry needs physical strength; most work in the retail/wholesale work place belong to the informal sector. Local urban residents may not prefer to work in these two industry sectors, therefore the probability of employment in these two industry sectors may be higher for migrants, which causes the proportion of workers in the construction and retail/wholesale sectors to be greater for migrants than for local urban residents.

For the manufacturing industry, in 2002, the proportion of migrants (9.7%) is smaller than that of local urban residents (25.7%), whereas in 2013, the proportion of migrants (17.0%) is greater than that of local urban residents (14.4%). It may be caused by the increase of POEs and PIEs in the manufacturing industry from 2002 to 2013. According to Lewis (1954), the wage level of migrants can be set low, which is nearly equal to subsistence level. Thus with the progress of marketization reform and globalization, in order to reduce the labor cost and gain the maximum profit, the labor demand of POEs and PIEs in the manufacturing industry may increase more for migrants than that for local urban residents.

For the service industry, in 2002, the proportion of migrants (21.7%) is greater than that of local urban residents (11.8%); in

¹⁵ Gustafsson & Li (2014), Campos, Ren, and Petrick (2016) point out the wage gap between the Han majority and no-Han majority in China, and the minority/majority income gap has widened rapidly during the economic transition period. However, Gustafsson and Li (2014) indicate there is no income gap between the Hui Muslim minority and Han majority in Ningxia rural region. These results show that the wage gap between the Hui Muslim minority and Han majority differ by region (e.g. minority region vs. national region, urban region vs. rural region).

¹⁶ Chen and Fleisher (1996), Chen and Groenewold (2010), Li and Haynes (2011), Song (2013), and Tian, Zhang, Zhou, and Yu (2016) indicate there remains the regional income disparity in China, the wage level is higher for the eastern region than that for the western- and central-regions; they also point out that the regional income inequality expanded since the 1990s.

Table 1
Statistics description.

Panel A: 2002												
	Migrant						Urban					
	Total	Cons.	Manu.	Retails	Service	Others	Total	Cons.	Manu.	Retails	Service	Others
Inwage rate	0.861	1.342	1.095	0.769	0.782	0.957	1.525	1.563	1.401	1.111	1.331	1.745
age	34	34	33	34	34	36	40	42	41	39	40	41
exp	26	26	25	27	26	27	29	30	31	28	29	28
Education category												
Primary school	0.254	0.250	0.179	0.275	0.264	0.222	0.036	0.054	0.050	0.049	0.043	0.021
Junior high school	0.546	0.566	0.547	0.562	0.538	0.505	0.266	0.259	0.357	0.372	0.297	0.182
Senior high school	0.177	0.164	0.233	0.151	0.172	0.229	0.375	0.393	0.389	0.418	0.417	0.345
College	0.023	0.020	0.041	0.012	0.025	0.044	0.323	0.294	0.204	0.161	0.243	0.451
Health status category												
Very good	0.354	0.336	0.314	0.366	0.343	0.364	0.250	0.259	0.207	0.263	0.236	0.273
Good	0.559	0.592	0.585	0.557	0.561	0.536	0.431	0.415	0.438	0.417	0.413	0.435
General	0.071	0.066	0.091	0.059	0.080	0.083	0.284	0.297	0.315	0.287	0.302	0.261
Bad	0.016	0.007	0.009	0.019	0.017	0.017	0.035	0.029	0.039	0.033	0.049	0.030
Party female	0.033	0.046	0.041	0.024	0.031	0.054	0.293	0.262	0.239	0.158	0.217	0.378
	0.567	0.868	0.594	0.509	0.536	0.675	0.559	0.700	0.591	0.454	0.431	0.592
Han race	0.916	0.901	0.906	0.924	0.920	0.896	0.959	0.971	0.970	0.956	0.965	0.951
Married	0.898	0.908	0.877	0.912	0.880	0.893	0.884	0.904	0.929	0.825	0.844	0.883
Ownership category												
Public sector	0.070	0.066	0.113	0.019	0.110	0.140	0.667	0.645	0.569	0.293	0.502	0.861
Private sector	0.116	0.270	0.226	0.067	0.122	0.140	0.138	0.192	0.231	0.212	0.177	0.054
Self-employment	0.730	0.559	0.585	0.891	0.671	0.475	0.091	0.070	0.034	0.363	0.180	0.030
Other	0.084	0.105	0.075	0.023	0.097	0.244	0.104	0.093	0.166	0.133	0.141	0.055
Region category												
East	0.368	0.388	0.447	0.342	0.368	0.390	0.391	0.422	0.368	0.453	0.527	0.350
Central	0.345	0.224	0.358	0.361	0.298	0.386	0.342	0.278	0.350	0.302	0.244	0.376
West	0.287	0.388	0.195	0.296	0.334	0.224	0.268	0.300	0.282	0.245	0.229	0.273
No. of observations	3289	152	318	1563	715	541	9577	313	2457	1169	1127	4511

Panel B: 2013												
	Migrant						Urban					
	Total	Cons.	Manu.	Retails	Service	Others	Total	Cons.	Manu.	Retails	Service	Others
Inwage rate	2.143	2.411	2.179	2.031	2.162	2.175	2.310	2.481	2.302	2.040	2.153	2.466
age	37	41	35	37	38	37	41	42	40	40	40	41
experience	28	32	26	28	29	27	29	31	29	30	29	29
Education category												
Primary school	0.142	0.191	0.105	0.170	0.130	0.110	0.047	0.100	0.044	0.070	0.062	0.027
Junior high school	0.515	0.564	0.545	0.539	0.502	0.437	0.261	0.351	0.322	0.367	0.300	0.173
Senior high school	0.224	0.182	0.244	0.223	0.223	0.228	0.304	0.287	0.368	0.366	0.308	0.258
College	0.120	0.064	0.105	0.068	0.144	0.224	0.388	0.262	0.266	0.196	0.329	0.542
Health status category												
Very good	0.397	0.382	0.493	0.380	0.326	0.413	0.340	0.334	0.327	0.318	0.318	0.364
Good	0.469	0.455	0.426	0.489	0.526	0.429	0.480	0.519	0.483	0.498	0.478	0.467
General	0.121	0.145	0.077	0.120	0.135	0.134	0.161	0.130	0.169	0.164	0.178	0.155
Bad	0.014	0.018	0.005	0.011	0.014	0.024	0.019	0.017	0.021	0.021	0.026	0.014
Party	0.043	0.000	0.053	0.030	0.051	0.071	0.208	0.123	0.135	0.050	0.148	0.328
Female	0.590	0.836	0.555	0.484	0.581	0.701	0.557	0.804	0.610	0.405	0.494	0.598
Han race	0.950	0.955	0.967	0.936	0.967	0.945	0.952	0.940	0.968	0.941	0.953	0.953
Married	0.844	0.918	0.799	0.864	0.847	0.811	0.866	0.909	0.865	0.856	0.831	0.879
Ownership category												
Public sector	0.088	0.036	0.086	0.016	0.047	0.272	0.407	0.185	0.272	0.078	0.211	0.685
Private sector	0.391	0.409	0.694	0.259	0.349	0.398	0.323	0.464	0.620	0.364	0.400	0.164
Self-employment	0.444	0.400	0.187	0.695	0.460	0.224	0.189	0.232	0.074	0.511	0.240	0.073
Other	0.077	0.155	0.033	0.030	0.144	0.106	0.081	0.119	0.034	0.046	0.149	0.078

(continued on next page)

Table 1 (continued)

Panel B: 2013												
	Migrant						Urban					
	Total	Cons.	Manu.	Retails	Service	Others	Total	Cons.	Manu.	Retails	Service	Others
Region category												
East	0.432	0.345	0.660	0.411	0.363	0.374	0.419	0.362	0.544	0.389	0.431	0.392
Central	0.395	0.345	0.301	0.418	0.400	0.449	0.350	0.304	0.323	0.336	0.313	0.385
West	0.173	0.309	0.038	0.170	0.237	0.177	0.231	0.334	0.133	0.275	0.256	0.223
No. of observations	1228	110	209	440	215	254	9620	470	1390	1685	1780	4295

Panel A: 2002:

Source: Calculated based on CHIP2002.

Note: Samples limited on age 16–60.

Panel B: 2013:

Source: Calculated based on CHIP2013.

Note: Samples limited on age 16–60.

Table 2

Industry distributions.

	2002		2013	
	Migrant	Urban	Migrant	Urban
Construction	4.6%	3.3%	9.0%	4.9%
Manufacturing	9.7%	25.7%	17.0%	14.4%
Retail/catering	47.5%	12.2%	35.8%	17.5%
Service	21.7%	11.8%	17.5%	18.5%
Other	16.4%	47.1%	20.7%	44.6%
Total	100.0%	100.0%	100.0%	100.0%

Source: Calculated based on CHIP2002 and CHIP2013.

2013, the proportion of local urban residents (18.5%) is almost similar with migrants (17.5%). The proportion of migrants in the service industry decreased from 2002 to 2013, whereas it increased for the urban residents.

It is observed that the proportions in various industry sectors differ for migrants and local urban residents, and these proportions changed from 2002 to 2013. It is predicted that these industry distribution proportional differences and the changes may affect the wage gap between migrants and local urban residents during the 2000s.

5.3. The mean values and standard deviations of wages by industry categories

Then, to consider the industrial wage disparity, we summarize the mean values and standard deviations of wages by industry categories in Table 3. It is shown that the mean and standard deviations of wages are different by industry categories, and by the

Table 3

Mean values and standard deviations of wages by industry categories.

	Migrant		Urban		Gap
	Mean.	S.D.	Mean.	S.D.	M/U (%)
Construction	4.762	3.488	6.176	5.431	77.1
Manufacturing	3.896	3.445	4.965	4.062	78.5
Retail/wholesale	2.792	3.209	4.177	4.379	66.8
Service	2.645	2.021	5.091	5.103	52.0
Other	3.588	4.695	6.978	5.504	51.4
Total	3.087	3.377	5.875	5.160	52.5
Construction	12.955	7.289	15.729	15.062	82.4
Manufacturing	10.755	6.946	12.951	17.229	83.0
Retail/wholesale	9.831	9.268	10.493	11.001	93.7
Service	11.525	9.418	12.514	16.588	92.1
Other	11.176	9.386	15.052	12.517	74.2
Total	10.833	8.838	13.512	14.114	80.2

Source: Calculated based on CHIP2002 and CHIP2013.

Note: Gap = mean values of migrants/mean values of local urban residents.

migrant and local urban resident groups. For example, in the migrant group, the logarithm of wage rates is highest for the construction industry in 2002 (4.762) and 2013 (12.955). Whereas in local urban residents group, it is highest for the other industry group (6.978) in 2002, and it is highest for the construction industry (15.729) in 2013.

It is also observed that the wage gap between migrants and local urban residents differs by industry sectors. For example, when the wage gap is expressed as the ratio of mean value of wages of the migrant group to that of the local urban resident group, the wage gap is greatest in the other industry sector (51.4% in 2002, 74.2% in 2013), it is smallest in the manufacturing industry in 2002 (78.5%), and in the retail and wholesale industry in 2013 (93.7%). Moreover, the results of total industries show that the wage gap decreases from 52.5% (2002) to 80.2% (2013), the results are consistent with the fact of the decrease of the surplus labor in the rural regions and the increase of the labor demand in the labor-intensive industry since 2004 and the significant increase of the migrant wage (Cai & Wang, 2008; Minami & Ma, 2014).

Although these tabulation calculation results indicate that the proportional industry distributions are different for migrants and local urban residents; the situation of industrial wage disparity differs between these two groups, and the wage gaps between the two groups changed from 2001 to 2013, yet the other factors (e.g. educational attainment and experience years) that may affect the probabilities of entry to industries and the wage level differentials have not been controlled in these results. An econometric analysis is therefore conducted as follows.

6. Econometric analysis results

6.1. Which factors affect the probability of entry to an industry sector?

To investigate the factors that affect the probability of entry to the various industry sectors, the estimations based on the multinomial logistic regression model are made, and the results are shown in Table 4. The reference group is the manufacturing industry. The main findings are as follows.

First, (1) for migrants, in 2002, age affects the possibility of entry to the retail/wholesale industry, and the possibility of entry to the retail/wholesale industry is greater for the younger group; whereas the age variables are statistically insignificant for all industry categories in 2013. It may be because the younger surplus labor was more for 2002, and the labor demand for younger workers in the retail/wholesale industry is higher than that for the other industries in 2002. (2) For local urban residents, the possibility of entry to the services and the other industries is smaller for younger workers, whereas they are greater for middle-aged workers in 2002. The influence of age on all industry categories is statistically insignificant in 2013, which is similar to the results for migrants in 2013. There may be two reasons to explain the results. One, it may be because younger urban residents do not prefer to enter the service industry sector. The other reason is related to SOEs reform promoted by the government since the end of 1990s. With the progress of SOEs reform, the employment in the other industry sectors which includes the monopolistic industries decreased, therefore the employment of the new graduates (younger workers) decreased in 2002.

Second, in both 2002 and 2013, education affects the choice of entry to industry. For example, in 2013, for both migrants and local urban residents, the possibility of entry to service industry (migrants 0.788, local urban residents 0.381), and other industry (migrants 1.278, local urban residents 1.384) for workers with higher education (college/university) are greater than those of workers with low or mid-level education. The results may be because the labor demand and supply for low, middle and high education workers differs in the various industry sectors. For example, because the wage level in the other industry sector which includes the monopolistic industries is higher, therefore the labor supply of the high-education level workers (or high skilled workers) may be higher for the other industry. In addition, because the service industry sector includes the science service and information/technology service industries, it is predicted that in these industry sectors, the labor demand for the high skilled works may be higher.

Third, party membership is a factor. For example, for local urban residents, in both 2002 and 2013, the possibility of entry to the retail/wholesale industry for communist party members is lower (-0.219 in 2002, -0.919 in 2013) than that for manufacturing industry, whereas the difference of possibility of entry to construction industry, service industry and other industry to manufacturing industry is smaller. It may be because most work places in the retail/wholesale industry belong to the informal sector, whereas the party organizations are established in the formal sector, particularly in the monopolistic industry sector, therefore the possibility of entry to the informal sector is lower for party member. For migrants, party dummy variables are not statistically significant in both 2002 and 2013. The results for migrants may be because the proportion of party members is smaller in the migrant group. For example, based on Table 1, it is observed that the proportion of party members in the migrant group is 2.4% (the retail/wholesale industry) \sim 5.4% (the other industry) in 2002, and 0.0% (the construction industry) \sim 7.1% (the other industry) in 2013. It also may be because most migrants enter the competitive industry sectors, in which recruitment is determined by labor productivity, not the party membership.

Fourth, the other characteristics affect the possibility of entry to industry sectors. Concretely, the possibility entry to the construction industry is lower for both migrant females (-1.576) and local urban resident (-0.996) females in 2013. Marital status is also a factor. For example, the probability of entry to the service industry is lower for married local urban residents in 2013. It can be considered that the physical strength, and the responsibility for child/elderly care and the other housework are different by gender, therefore these results may be caused by the gender self-selection disparity.

Fifth, in both 2002 and 2013, the possibilities of entry to construction, retail/wholesale, service, and other industries, are higher in the West and Central regions, whereas the possibilities of entry to the manufacturing industry are relatively higher in the East region for both migrants and local urban residents. These results might be caused by regional disparities in industry distributions. For example, the government implemented a set of regional development policies during the period of economic transition. The Chinese

Table 4
Results of probability of entry to industry.

Panel A: 2002								
	Construction		Retail/wholesale		Service		Others	
	Migrant	Urban	Migrant	Urban	Migrant	Urban	Migrant	Urban
Age	0.023 (0.24)	0.008 (0.13)	0.137** (2.40)	-0.074* (-1.96)	0.015 (0.25)	-0.078** (-2.06)	-0.024 (-0.38)	-0.072** (-2.51)
Age squared	-4.666E-04 (-0.38)	4.200E-05 (0.05)	-0.002** (-2.16)	0.001 (1.39)	4.460E-05 (0.06)	0.001** (2.06)	0.001 (0.83)	0.001** (2.83)
Education (Junior high school)								
Primary school	0.416* (1.62)	0.307 (1.10)	0.275* (1.63)	0.038 (0.23)	0.247 (1.35)	0.103 (0.58)	0.206 (1.06)	-0.265* (-1.84)
Senior high school	-0.439* (-1.65)	0.325** (2.18)	-0.394** (-2.50)	-0.102 (-1.24)	-0.241 (-1.39)	0.164* (1.89)	0.004 (0.02)	0.481** (7.46)
College/university	-0.597 (-1.00)	0.651*** (3.85)	-1.142*** (-3.01)	-0.500*** (-4.58)	-0.382 (-1.00)	0.264** (2.53)	0.333 (0.92)	1.299*** (17.74)
Health	0.318 (0.91)	0.127 (0.99)	0.418** (1.99)	0.079 (1.04)	0.197 (0.87)	0.002 (0.03)	0.015 (0.06)	0.217*** (3.92)
Party	-0.098 (-0.20)	-0.092 (-0.64)	-0.417 (-1.28)	-0.219** (-2.23)	-0.273 (-0.78)	-0.043 (-0.46)	-0.168 (-0.49)	0.423*** (6.87)
Female	-1.683*** (-6.25)	-0.480*** (-3.69)	0.313** (2.44)	0.511*** (7.05)	0.215 (1.54)	0.666*** (9.06)	-0.276* (-1.84)	0.073 (1.37)
Married	0.115 (0.28)	-0.382 (-1.44)	-0.135 (-0.54)	-0.570*** (-3.85)	-0.272 (-1.02)	-0.612*** (-4.08)	-0.034 (-0.12)	-0.377*** (-3.17)
Han race	-0.101 (-0.32)	0.152 (0.42)	0.197 (0.91)	-0.335* (-1.79)	0.162 (0.68)	-0.152 (-0.76)	-0.105 (-0.44)	-0.481*** (-3.41)
Region (East)								
West	-0.481* (-1.92)	-0.341** (-2.35)	0.294** (2.08)	-0.288*** (-3.46)	0.034 (0.22)	-0.688*** (-7.97)	0.189 (1.17)	0.127** (2.08)
Central	0.652*** (2.75)	0.007 (0.05)	0.622*** (3.79)	-0.265*** (-2.98)	0.691*** (3.93)	-0.500*** (-5.61)	0.240 (1.26)	0.075 (1.15)
Constants	-0.827 (-0.53)	-2.346* (-1.84)	-1.855* (-1.93)	2.029*** (2.87)	-0.124 (-0.12)	1.362* (1.90)	0.510 (0.48)	1.691*** (3.10)
No. of observations	3330	9927						
Log likelihood	-4365.867	-12,465.713						
Pseudo R2	0.031	0.0556						
Panel B: 2013								
	Construction		Retail/wholesale		Service		Others	
	Migrant	Urban	Migrant	Urban	Migrant	Urban	Migrant	Urban
Age	0.113 (1.05)	-0.048 (-0.99)	0.040 (0.54)	0.002 (0.06)	0.153* (1.73)	-0.040 (-1.24)	0.100 (1.19)	-0.010 (-0.34)
Age squared	-0.001 (-0.54)	0.001 (1.31)	-3.794E-04 (-0.40)	3.920E-05 (0.10)	-0.001 (-1.26)	0.001* (1.69)	-0.001 (-0.83)	4.585E-04 (1.29)
Education (Junior high school)								
Primary school	-0.061 (-0.16)	0.551* (2.54)	0.091 (0.33)	0.159 (0.94)	-0.261 (-0.80)	0.149 (0.87)	-0.195 (-0.60)	-0.022 (-0.13)
Senior high school	-0.179 (-0.56)	-0.224* (-1.66)	-0.021 (-0.10)	-0.059 (-0.67)	0.096 (0.39)	-0.054 (-0.60)	0.165 (0.68)	0.265*** (3.23)
College/university	0.188 (0.38)	0.189 (1.26)	-0.229 (-0.72)	-0.247** (-2.34)	0.788** (2.37)	0.381*** (3.80)	1.278*** (4.16)	1.384*** (15.44)
Health	-0.280 (-0.72)	0.517*** (3.41)	-0.262 (-0.86)	0.109 (1.14)	-0.314 (-0.94)	-0.019 (-0.21)	-0.599* (-1.86)	0.184** (2.19)
Party	-15.150 (-0.03)	-0.263 (-1.55)	-0.703* (-1.62)	-0.919*** (-6.48)	-0.412 (-0.89)	0.069 (0.63)	-0.183 (-0.44)	0.702*** (7.73)
Female	-1.576*** (-5.21)	-0.996*** (-7.67)	0.175 (1.01)	0.800*** (10.66)	-0.166 (-0.82)	0.482*** (6.54)	-0.704*** (-3.49)	0.142** (2.15)
Married	0.370 (0.76)	0.413* (1.95)	0.220 (0.75)	-0.144 (-1.13)	-0.233 (-0.69)	-0.301** (-2.44)	-0.152 (-0.47)	0.004 (0.03)
Han race	-0.421 (-0.67)	-0.520** (-2.11)	-0.745 (-1.67)	-0.489*** (-2.67)	-0.059 (-0.11)	-0.250 (-1.33)	-0.746 (-1.54)	-0.276* (-1.62)

(continued on next page)

Table 4 (continued)

Panel B: 2013								
	Construction		Retail/wholesale		Service		Others	
Region (East)								
West	0.904*** (3.20)	0.376*** (2.91)	0.866*** (4.65)	0.398*** (4.77)	0.950*** (4.34)	0.262*** (3.19)	1.001*** (4.77)	0.671*** (9.39)
Central	2.801*** (6.28)	1.325*** (9.54)	1.933*** (4.92)	1.034*** (10.08)	2.438*** (5.94)	0.904*** (8.91)	2.133*** (5.18)	0.991*** (10.6)
Constants	-3.679* (-1.80)	-0.898 (-0.95)	0.046 (0.03)	-0.040 (-0.06)	-3.667** (-2.20)	0.636 (1.01)	-1.348 (-0.87)	-0.422 (-0.73)
No. of observations	1228	9620						
Log Likelihood	-1766.161		-12,707.1630					
Pseudo R2	0.069	0.0749						

Panel A: 2002:

Source: Calculated based on CHIP2002.

2. Reference group in multinomial logit regression model analysis is manufacturing industry group.

3. z values are shown in the parentheses.

Note: 1. *, **, ***: statistically significant level are 10%, 5%, 0.1%.

Panel B: 2013:

Source: Calculated based on CHIP2013.

Note: 1. *, **, ***: statistically significant level are 10%, 5%, 0.1%.

2. Reference group in multinomial logit regression model analysis is manufacturing industry group.

3. z values are shown in the parentheses.

Table 5

Results of wage function (total samples).

	2002				2013			
	Migrant		Urban		Migrant		Urban	
	coef.	t value	coef.	t value	coef.	t value	coef.	t value
Industries (manufacturing)								
Construction	0.223***	3.62	0.087**	2.42	0.233***	2.78	0.205***	5.32
Retail/catering	-0.250***	-6.38	-0.092***	-4.04	-0.095	-1.54	-0.116***	-4.22
Service	-0.229***	-5.45	-0.050**	-2.25	0.025	0.36	-0.086***	-3.29
Other	-0.081*	-1.82	0.210***	13.13	-0.034	-0.51	0.044*	1.85
Experience years	0.016*	1.96	0.026***	6.65	0.014	0.92	0.023***	4.96
Experience years sq.	-3.981E-04***	-3.27	0.000***	-4.00	-0.001***	-2.77	-4.884E-04***	-6.46
Education (Junior high school)								
Primary school	-0.116***	-3.37	-0.231***	-3.71	0.197**	2.18	0.019	0.38
Senior high school	0.277**	2.27	0.266***	5.45	0.037	0.58	0.006	0.13
College/university	0.750*	1.87	0.678***	5.05	-0.346	-1.11	-0.098	-0.58
Health	-0.094	-0.74	0.044*	1.87	0.281***	2.57	-0.016	-0.59
Party	0.214*	1.64	0.207***	3.66	0.151	0.89	-0.241**	-2.10
Female	-0.518**	-2.15	-0.115**	-2.40	0.042	0.19	-0.178***	-4.58
Han race	-0.062	-0.52	-0.191***	-3.27	0.465***	2.68	0.115***	2.98
Ownership (public)								
Private	0.198***	3.77	-0.172***	-8.95	-0.075	-0.98	-0.054***	-2.69
Self-employed	0.104**	2.32	-0.470***	-19.13	-0.030	-0.37	-0.089***	-3.55
Other	-0.066	-1.19	-0.123***	-5.87	-0.403***	-4.02	-0.234***	-7.87
Region (East)								
Central	-0.408***	-7.39	-0.311***	-5.64	-0.557***	-3.87	-0.530***	-9.39
West	-0.376**	-2.52	-0.266***	-7.67	-0.673**	-2.27	-0.454***	-7.58
correct item1	9.686	1.04	5.656	1.53	11.524	1.48	5.819***	2.62
correct item2	-7.983	-0.89	-5.456**	-2.52	-6.901	-0.80	-3.024	-1.22
correct item3	5.660	0.57	-2.214	-0.96	-10.614	-1.26	-6.374**	-2.42
correct item4	7.860	0.93	-6.110***	-2.85	-10.678	-1.59	-3.019	-1.46
correct item5	-8.165	-0.72	-3.630	-1.56	-14.149	-1.48	-9.200***	-3.94
Constants	-25.811	-0.81	16.901**	2.44	38.392	1.42	20.583***	2.71
No. of observations	3289		9577		1228		9620	
Adj R-squared	0.175		0.311		0.149		0.201	

Source: Calculated based on CHIP2002 and CHIP2013.

Note: *, **, ***: statistically significant levels are 10%, 5%, 0.1%.

government enforced the economic reform in the East region in the initial stage: the government permitted privately-owned enterprises and foreign-owned enterprises in the manufacturing industry entrance to the East region. Since the 2000s, the government promoted the West region and the Central region development policies to reduce the regional disparities but the manufacturing industry remains concentrated in the East region with an accumulation of manufacturing industry in the eastern coastal area.

6.2. Do industrial wage disparities exist?

Do industrial wage disparities exist? To answer the question, wage functions including dummy variables for industry categories are estimated. The results are shown in Table 5.

First, the Maddala model (Maddala, 1983) is used to adjust the sample selection bias caused by the choice of entry to an industry. Because a worker should decide to enter an industry sectors based on the choice from five industry sector options (the manufacturing, construction, retail/wholesale, service and the other industries in the study) simultaneously, it is thought that a worker will compare the utilities of these choice options to select an industry sector where he/she can gain the maximum profit. Thus the five kinds of selection bias should be corrected. The five correct items (correct item1 to correct item5 in Table 5) calculated based on multinomial probit regression model are used to adjust these selection bias. The marriage dummy variable and age are used as identification variables in the model. It is thought that marriage and age may affect the opportunity of entry to various industry sectors. For example, the opportunity of entry to competitive industries (e.g. the manufacturing, construction, retail/wholesale, service industries) may be higher for single and younger workers than married and older workers. If these correct items are statistically significant, they show the selection bias may exist without the correction. In both 2002 and 2013, the correct items are not statistically significant for migrants, it is indicated that the influence of marital status and age on the decision to entry to various industry sectors is smaller. This may be because there are not more job selection options for the migrants. Whereas in both 2002 and 2013, the correct items are statistically significant for the local urban residents group and the coefficients of these correct items are negative values for the construction industry and the service industry in 2002, positive values for the manufacturing industry and the other industry in 2013. It is shown that for the local urban residents group, the wage function results by the OLS model may be overestimated or underestimated when these selection biases are not adjusted. Because local urban resident workers may have more opportunities to choose an industry sector which they prefer to enter, these correct item results have more sensitivity for local urban residents than migrants.

Second, industrial wage disparities do exist for both migrants and local urban residents. For example, holding the other factors constant, compared with manufacturing industry, wage levels in construction are higher for both migrants (0.223 in 2002, 0.233 in 2013) and local urban residents (0.087 in 2002, 0.205 in 2013). Moreover, for the local urban residents group, compared with manufacturing industry, wages levels are lower in retail and wholesale industry as well as in service industry in both 2002 and 2003. For migrants, wages levels are lower in 2003 in the retail and wholesale, service, and other industries, whereas the industrial wage gaps between manufacturing, retail and wholesale, service, and other industries are not statistically significant in 2013. The industrial wage disparities may be caused by individual characteristics differentials (e.g. education attainment) in various industry sectors, and it may be because the wage determination systems differ in the monopolies and competitive industry sectors. It is predicted that these factors may influence the wage gap between migrants and local urban residents.

6.3. How do industrial factors affect the wage gap between migrants and local urban residents?

To decompose the influences of industrial factors on the wage gap based on the Brown model, firstly, wage functions by industry category are estimated. The results are shown in Table 6. The estimations show in both 2002 and 2013 that human capital, gender, and ownership have the greatest effect on wage levels in various industry sectors; the influences of human capital on wage levels differ between migrants and local urban residents, they are greater for the local urban residents. These results are consistent with previous studies on the wage structures of migrants and local urban residents in urban China (Wang, 2003; Zhang & Xue, 2008; Zhang, 2012; and Ma, 2014, 2015, 2016a). These results can be explained by the human capital theory, and the labor segmentation hypotheses.

Then, based on the estimated results shown in Table 4, the implied industry sector distributions are calculated, and the results summarized in Table 7. The main findings are as follows.

In 2002, if discrimination against migrants does not exist (based on the assumption that the migrants have the same opportunity to entrance to an industry sector), the proportions in the manufacturing and the other industries will increase, whereas the proportions in the construction, the retail/wholesale, and the service industries will decrease. For local urban residents, if the advantage for local urban residents does not exist (based on the assumption that the opportunity of entry to an industry sector for local urban residents is similar with migrants), the proportions in the manufacturing and the other industries will decrease, whereas the proportions in the construction, the retail/wholesale, and the service industries will increase.

Moreover, in 2013, for migrants, if the discrimination against migrants does not exist, the proportions in the construction, the manufacturing and the service industries will increase, whereas the proportions of migrants in the retail/wholesale, and the other industries will decrease. For local urban residents, if the advantage for local urban residents does not exist, the proportion in the manufacturing and the other industries will decrease, whereas the proportions in the manufacturing, the retail/wholesale, and the service industries will increase.

It should be noticed that in both 2002 and 2013, for local urban residents, if there is no discrimination against migrants, the proportion of workers in the other industry sector should decrease 11.4% in 2002 and 29.6% in 2013. Because the other industry

Table 6
Results of wage function by industry categories.

Panel A: 2002										
	Construction		Manufacturing		Retail/wholesale		Service		Others	
	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban
Experience	0.057*	0.036*	0.059***	0.025***	0.007	0.043***	0.022*	0.008	0.039***	0.033***
	(1.93)	(1.85)	(2.96)	(3.29)	(0.56)	(3.99)	(1.82)	(0.73)	(2.74)	(7.46)
Experience sq.	-0.001	-1.810E-04	-0.001***	-2.935E-04***	-2.463E-04	-0.001***	0.000**	4.700E-05	-0.001***	0.000***
	(-1.33)	(-0.53)	(-3.07)	(-2.32)	(-1.27)	(-4.51)	(-2.42)	(0.24)	(-3.21)	(-3.85)
Education (Junior high school)										
Primary school	-0.339**	-0.062	-0.076	-0.192***	-0.112***	0.074	-0.096*	-0.202*	-0.114	-0.154**
	(-2.13)	(-0.23)	(-0.63)	(-3.32)	(-2.75)	(0.72)	(-1.66)	(-1.83)	(-1.39)	(-2.02)
Senior high school	0.441**	0.171	0.262**	0.255***	0.180**	0.105	0.176***	0.218***	4.173E-04	0.180***
	(2.44)	(1.52)	(2.13)	(6.80)	(2.20)	(1.50)	(2.88)	(4.22)	(0.00)	(2.89)
College/university	0.883**	0.536***	0.426*	0.556***	0.556*	0.065	0.523***	0.580***	-0.469	0.317**
	(2.25)	(4.32)	(1.69)	(7.89)	(1.92)	(0.41)	(3.74)	(7.26)	(-0.80)	(2.03)
Health	-0.142	0.044	-0.086	0.016	0.027	-0.002	0.013	-0.007	0.236	-0.049*
	(-0.69)	(0.56)	(-0.60)	(0.59)	(0.25)	(-0.05)	(0.18)	(-0.15)	(1.28)	(-1.76)
Party	0.025	-0.063	0.313	0.148***	0.070	0.077	-0.017	0.031	-0.138	0.034
	(0.09)	(-0.43)	(1.46)	(4.41)	(0.49)	(1.12)	(-0.14)	(0.50)	(-0.77)	(0.61)
Female	0.373	-0.305	-0.241***	-0.093**	-0.304**	-0.073	-0.191***	-0.234***	0.016	-0.035
	(0.88)	(-1.24)	(-3.12)	(-3.10)	(-2.46)	(-1.26)	(-3.41)	(-2.75)	(0.07)	(-1.39)
Ownership (public)										
Private	-0.032	0.074	0.076	-0.120***	0.137	-0.143**	0.217**	-0.368***	0.360***	-0.199***
	(-0.15)	(0.75)	(0.57)	(-4.19)	(1.04)	(-2.50)	(2.44)	(-6.60)	(3.29)	(-5.24)
Self-employed	0.101	-0.128	0.006	-0.360***	-0.013	-0.477***	0.151**	-0.596***	0.170*	-0.445***
	(0.48)	(-0.87)	(0.05)	(-5.61)	(-0.11)	(-9.18)	(2.17)	(-10.28)	(1.86)	(-8.79)
Other	-0.136	0.007	-0.025	-0.053*	-0.136	0.025	0.004	-0.380***	-0.066	-0.145***
	(-0.54)	(0.06)	(-0.14)	(-1.67)	(-0.87)	(0.39)	(0.04)	(-6.34)	(-0.68)	(-3.87)
Han race	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Correct item	-12.010	24.688	-3.269	-1.559**	-2.175	4.201***	4.138*	-0.754	-9.984*	-1.313
	(-1.37)	(1.41)	(-0.64)	(-2.23)	(-0.99)	(2.72)	(1.64)	(-0.39)	(-1.77)	(-1.39)
Constants	9.482	-18.451	3.052	2.018***	2.125	-1.727*	-2.220	2.066*	7.199*	1.877***
	(1.51)	(-1.35)	(0.89)	(4.04)	(1.41)	(-1.85)	(-1.39)	(1.64)	(1.93)	(3.24)
Samples	152	313	318	2452	1563	1169	715	1127	541	4511
Adj R-squared	0.165	0.2469	0.179	0.187	0.099	0.287	0.151	0.290	0.206	0.233

Panel B: 2013										
	Construction		Manufacturing		Retail/wholesale		Service		Others	
	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban
Experience	0.011	0.080***	0.074***	0.026***	0.041***	0.047***	0.021	0.024**	0.038*	0.025***
	(0.33)	(5.65)	(3.09)	(3.14)	(2.64)	(2.14)	(0.72)	(2.33)	(1.79)	(5.01)
Experience sq.	-4.071E-04	-0.001***	-0.001***	-4.117E-04***	-0.001**	-0.001***	-0.001	-3.772E-04**	-0.001**	-4.747E-04***
	(-0.86)	(-4.85)	(-3.46)	(-2.92)	(-2.19)	(-4.48)	(-1.51)	(-2.26)	(-2.23)	(-5.69)
Education (Junior high school)										
Primary school	0.041	-0.116	-0.085	-0.045	-0.029	-0.022	0.494**	-0.062	0.159	0.044
	(0.26)	(-0.75)	(-0.52)	(-0.44)	(-0.23)	(-0.26)	(2.22)	(-0.72)	(0.91)	(0.57)
Senior high school	0.224**	-0.005	0.073	0.190***	0.271***	0.249***	0.052	0.154***	0.030	0.005
	(1.40)	(-0.06)	(0.63)	(3.91)	(3.17)	(4.59)	(0.36)	(2.80)	(0.21)	(0.10)
College/University	0.129***	0.460***	0.547***	0.559***	0.742***	0.726***	-0.048	0.598***	-0.199	-0.182
	(0.46)	(3.87)	(2.99)	(8.90)	(2.76)	(4.38)	(-0.18)	(7.27)	(-0.43)	(-1.12)
Health	-0.003	0.016	-0.031	0.043	0.094	0.071	0.145	0.073	0.215	0.041
	(-0.02)	(0.16)	(-0.18)	(0.81)	(0.95)	(1.47)	(0.94)	(1.33)	(1.16)	(1.32)
Party	(omitted)	-0.141	-0.165	0.234***	0.170	0.175	0.183	-0.033	0.013	-0.359***
	(omitted)	(-1.26)	(-0.58)	(3.53)	(0.82)	(1.21)	(0.74)	(-0.49)	(0.05)	(-3.70)
Female	-0.084	-0.178	-0.260	-0.045	-0.434**	-0.402***	-0.440***	-0.156***	-0.259	-0.113***
	(-0.26)	(-1.28)	(-1.40)	(-0.54)	(-2.44)	(-3.54)	(-3.81)	(-2.79)	(-1.10)	(-3.88)

(continued on next page)

Table 6 (continued)

Panel B: 2013										
	Construction		Manufacturing		Retail/wholesale		Service		Others	
	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban	Migrants	Urban
Ownership										
(public)										
Private	-0.098 (-0.32)	-0.143 (-1.57)	0.250 (1.43)	-0.059 (-1.33)	-0.129 (-0.49)	0.021 (0.29)	-0.162 (-0.63)	-0.025 (-0.50)	-0.216* (-1.86)	-0.073** (-2.44)
Self-employed	0.083 (0.27)	-0.045 (-0.42)	0.335 (1.73)	0.114 (1.48)	-0.247 (-0.97)	-0.055 (-0.77)	0.145 (0.57)	-0.052 (-0.87)	-0.157 (-1.18)	-0.119*** (-2.78)
Other	-0.036 (-0.11)	-0.142 (-1.11)	-0.588* (-1.93)	-0.373*** (-3.56)	-0.439 (-1.41)	-0.025 (-0.23)	-0.450 (-1.59)	-0.238*** (-3.68)	-0.440*** (-2.59)	-0.284*** (-6.79)
Han race	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Correct item	-2.033 (-0.50)	0.997 (0.33)	-2.836 (-0.83)	-4.141* (-1.84)	-1.417 (-0.68)	-1.721 (-1.05)	-5.921 (-1.30)	2.974* (1.66)	-3.290 (-0.92)	-4.148*** (-4.33)
Constants	4.389 (1.29)	1.181 (0.52)	3.485 (1.28)	5.229*** (3.08)	2.458** (2.01)	2.741*** (2.59)	7.014* (1.87)	0.021 (0.02)	4.210* (1.85)	5.070*** (7.29)
Samples	110	470	209	1390	440	1685	215	1780	254	4295
Adj R-squared	0.1159	0.1345	0.168	0.142	0.127	0.128	0.151	0.208	0.130	0.169

Panel A: 2002:

Source: Calculated based on CHIP2002.

Note: 1. *, **, ***: statistically significant levels are 10%, 5%, 0.1%.

2. z values are shown in the parentheses.

Panel B: 2013:

Source: Calculated based on CHIP2013.

Note: 1. *, **, ***: statistically significant levels are 10%, 5%, 0.1%.

2. z values are shown in the parentheses.

Table 7

Industry distributions by the actual values and the imputed values.

	Actual value		Imputed value		Differentials (I-A)	
	Migrant	Urban	Migrant	Urban	Migrant	Urban
2002						
Construction	4.6%	3.3%	2.9%	13.7%	-1.7%	10.4%
Manufacturing	9.7%	25.7%	24.7%	10.9%	15.1%	-14.8%
Retail/Catering	47.5%	12.2%	28.0%	19.1%	-19.5%	6.9%
Service	21.7%	11.8%	12.2%	20.7%	-9.5%	9.0%
Other	16.3%	47.0%	32.1%	35.6%	15.8%	-11.4%
Total	100.0%	100.0%	100.0%	100.0%		
2013						
Construction	9.0%	4.9%	13.2%	3.6%	4.3%	-1.3%
Manufacturing	17.0%	14.4%	17.6%	17.6%	0.6%	3.1%
Retail/catering	35.8%	17.5%	25.3%	26.8%	-10.5%	9.3%
Service	17.5%	18.5%	31.9%	36.9%	14.4%	18.4%
Other	20.7%	44.7%	11.9%	15.1%	-8.8%	-29.6%
Total	100.0%	100.0%	100.0%	100%		

Source: Calculated based on CHIP2002 and CHIP2013.

sector includes the monopolistic industries, the results indicate discrimination against migrants when they enter the monopolistic industries during the 2000s.

The next question is how does discrimination against migrants when they enter these sectors affect the wage gap? How does discrimination against migrants in the same sectors affect the wage gap? The decomposition results shown in Table 8 are used to discuss these issues. Table 8 summarizes both the actual values and percentage contribution values to the wage gap. To be understood easily, percentage contribution values are used to introduce these findings as follows.

First, to compare the influences between intra-industry sector differentials and inter-industry sector differentials, the values of intra-industry sector differentials are 80.6% in 2002 and 145.7% in 2013, whereas the values of inter-industry sector differentials are 19.4% in 2002 and -45.7% in 2013. The results reveal that the influence on the wage gap is greater for the intra-industry sector differentials- they are the main factor underlying the wage gap in both 2002 and 2013, and their influence increased from 2002 to 2013. Both the intra-industry sector and inter-industry sector differentials can be divided into two parts-the explained component and

Table 8
Decomposition results based on Brown model.

	Estimation1		Estimation2	
	Actual value	Percentage (%)		Percentage (%)
2002				
Total wage differentials	0.6571	100.0%		
Inter-industry differential	0.1272	19.4%	100.0%	
Explained	0.0780	11.9%		61.4%
Unexplained	0.0492	7.5%		38.6%
Intra-industry differential	0.5299	80.6%	100.0%	
Explained	0.4022	61.2%		75.9%
Unexplained	0.1277	19.4%		24.1%
Total explained differentials	0.4802	73.1%		
Total unexplained differentials	0.1769	26.9%		
2013				
Total wage differentials	0.1676	100%		
Inter-industry differential	- 0.0767	- 45.70%		100%
Explained	- 0.0944	- 56.3%		- 123.1%
Unexplained	0.0177	10.6%		23.1%
Intra-industry differential	0.2443	145.7%	100%	
Explained	0.1303	77.7%		53.3%
Unexplained	0.1140	68.0%		46.7%
Total explained differentials	0.0359	21.4%		
Total unexplained differentials	0.1317	78.6%		

Source: Calculated based on CHIP2002 and CHIP2013.

the unexplained component, the detailed decomposition results need to be scrutinized in order to understand the influence of the intra-industry sector differentials and inter-industry differentials as the following.

Second, for the decomposition results of the influence of the intra-industry sector differentials, (1) the value of explained component (61.2% in 2002, 77.7% in 2013) is greater than that of the unexplained components (19.4% in 2002, 68.0% in 2013) in both 2002 and 2013. The results indicate that the differentials of individual characteristics (e.g. human capital) in the same industry sector are the main reason for the wage gap during the 2000s. To consider the results, it is known that the number of new generation migrants who are the children of first generation migrants is increasing in the recent period.¹⁷ Because compared with the first generation migrants, the education level is higher for the new generation migrants,¹⁸ it is predicted that the education attainment gap between migrants and local urban may decrease, which may contribute to reduce the wage gap. However, the calculated results shown in Table 1 indicate that differentials of human capital between the two groups remain: the proportion of low-education workers is greater in the migrant group than in the local urban resident group in both 2002 and 2013. Although the Chinese government enforced the compulsory education and increased public education investment in the rural regions, the education attainment gap continues into the 2000s. This may be because it takes time for these policies to reduce the education gap and it should be considered in the long-term. It is thought that vocational education and training for migrants helps to reduce the education gap in the short-term. However, vocational education and training for migrants by government and firms is scarce in China (Cai, Du, & Zhang, 2011).

(2) Moreover, the values of the unexplained component of intra-industry sector differentials are positive values in both 2002 and 2013, and the value rises greatly from 2002 to 2013 - they are 19.4% (2002) and 68.0% (2013). This result shows that if other factors are held constant, discrimination against migrants in the same industry sector is the main reason for the wage gap, and the problem of discrimination against migrants has become more serious in recent years.

The reasons for the positive value results in both 2002 and 2013 can be explained as follows. It may be because the wage determination systems differ by the migrants and local urban residents in the same industry sector. For example, in the monopolistic industries, the wage levels for the regular workers, most of whom are local urban residents, are controlled by the government. Firms in the monopolistic industries can let the local urban residents earn more than the market equilibrium wage because monopolies can gain monopoly rents; whereas because the migrants are surplus labor in the rural region, the wage level of migrants can be set at a low level just above subsistence level (Lewis, 1954). The difference of the wage determination system for the local urban residents and migrants may cause the wage gap in the same industry sector.

Why did the discrimination against migrants in the same industry sector increase during the 2000s? It can be explained as follows:

¹⁷ Based on the survey of new generation migrants conducted in 2010 by the NBS (The National Bureau of Statistics), there are 84.87 million new generation migrants, the ratio of new generation migrants to total migrants was 58.4% in 2010 (Cai et al., 2011).

¹⁸ Based on the survey of new generation migrants conducted in 2010 by the NBS, the average schooling years is longer for the new generation migrants (9.8 years) than that for the first generation migrants (8.8 years) (Cai et al., 2011).

the Chinese government implemented a set of policies such as the industry upgrade policy and the policies which promote the SOEs (the most of which are in the monopolistic industries) to enlarge. After the global financial crisis in 2007, the Chinese government provided greater public financial support to the SOEs in the monopolistic industry sectors to stimulate economic recovery. Thus the problem of the discrimination against migrants in the monopolistic industries became serious from 2002 to 2013.

Third, to consider the influence of the inter-industry sector differentials, the decomposition results show that the value of the unexplained component increased from 7.5% (2002) to 10.6% (2013), whereas the value of the explained component decreased from 11.9% (2002) to –56.3% (2013).

The results indicate when a migrant worker enters an industry sector, discrimination increased from 2002 to 2013. These results can be explained as follows. As described in Section 2.2, monopolistic industries are strengthened by the government's protection policies, and local urban residents are given preferential treatment in employment by the monopolistic industry sectors in which the influence of the employment system established in the period of planned economy is even greater. During the 2000s, particularly after the global financial crisis in 2007, the influence of government on the public sector has become greater, thus the problem of the administration against migrants to obtain job opportunities in the monopolistic industries may become serious from 2002 to 2013.

The results also show that influence of the evaluation differential of individual characteristics (e.g. human capital) on the opportunity gap decreased from 2002 to 2013, particularly it contributes to reduce the wage gap in 2013. It can be explained that for the probability to entrance to the competitive industries, when the other unobserved factors (e.g. effort to work, willingness to work long hours) are evaluated more positively for migrants than for local urban residents, the opportunities to enter the competitive industries may be higher for migrants.

Fourth, to consider the influence of overall explained differentials and unexplained differentials, the explained differentials (73.1%) are greater than the unexplained differentials (26.9%) in 2002, whereas the explained differentials (21.4%) are smaller than the unexplained differentials (78.6%) in 2013. These results indicate that explained differentials are the main factor in 2002, whereas the unexplained differentials are the main factor in 2013 and caused the wage gaps.

Because the results for 2013 are the newest results for the issue, here we compare the result for 2002 with the previous studies. The results of unexplained differentials for 2002 (26.9%) in the study are consistent with Guo and Zhang (2011), Ma (2016a), Chang and Zhao (2016), and Zhu (2016). The values of the unexplained differentials are 27% in 2002 (Guo & Zhang, 2011), 36.9% in 2002 (Ma, 2016a), 26.3% in 2002 (Zhu, 2016), 38.10% in 1993–2000 (Chang & Zhao, 2016) based on Oaxaca-Blinder model.

The new finding is the influence on wage gap is greater for the unexplained differentials than for the explained differentials in 2013. The result indicates that the influence of the unexplained differentials increased from 2002 to 2013. Based on the Brown Decomposition Model, the unexplained differentials includes wage discriminations against migrants when the migrants work together with local urban residents in the same industry sector, and when migrants try to enter an industry sector, particularly the monopolistic industries in which the wage level is higher. These results may be because during the 2000s, particularly after the global financial crisis in 2007, the monopolistic industries were strengthened by government protection policies, therefore the problem of discrimination against migrants became more serious.

7. Conclusions

This paper explores labor market segmentation by various industry sectors (e.g. the monopolistic industry sector and the competitive industry sector) and its impact on the wage gaps between rural-to-urban migrants and local urban residents in China. Using survey data from the Chinese Household Income Project (CHIP) conducted in two periods, 2003 and 2014, we analyzed the probabilities of entry to various industries for both migrant and local urban resident groups; using the Brown model, we then undertook a decomposition analysis of the wage gaps. Several major conclusions emerge.

First, to consider the overall influence of intra-industry differentials and inter-industry differentials on wage gaps, the results reveal that the intra-industry differentials are the main factors underlying the wage gap in both 2002 and 2013, and their influence increased from 2002 to 2013.

Second, to see the influence of intra-industry differentials, the value of explained component (61.2% in 2002, 77.7% in 2013) is greater than that of the unexplained components (19.4% in 2002, 68.0% in 2013) in both 2002 and 2013. The results indicate that the existence of differentials in individual characteristic (including human capital) in the same industry sector is main cause of the wage gaps. In addition, the value of the unexplained component of intra-industry differentials rises greatly from 19.4% (2002) to 68.0% (2013): this indicates that if other factors are held constant, the problem of discrimination against migrants in the same industry sector has become more serious in recent years.

Third, to see the influence of the inter-industry differentials: the value of the unexplained component increased from 7.5% (2002) to 10.6% (2013), whereas the value of the explained component decreased from 11.9% (2002) to –56.3% (2013). The results indicated the discrimination when a migrant worker enters an industry sector is increasing during 2002 to 2013, whereas the differentials of individual characteristics (e.g. human capital) between migrants and local urban residents groups decreased from 2002 to 2013: it contributes to reduce the wage gaps in 2013.

Fourth, to consider the influence of explained differentials and unexplained differentials: the explained differentials (73.1%) are greater than the unexplained differentials (26.9%) in 2002, whereas the explained differentials (21.4%) are smaller than the unexplained differentials (78.6%) in 2013. These results indicate that the explained differential are the main factor in 2002, whereas in 2013 the unexplained differentials are the main factor which caused the wage gap.

These findings indicate that to reduce wage gaps between migrants and local urban residents, employment equality laws and an equal pay for equal work policy are immediate priorities. Policies that aim to reduce human capital differentials between these two

groups, such as reducing the education gaps between the rural regions and urban regions, should be implemented in the long term, and vocational education and training systems for migrants should also be developed to increase the skill levels of migrants. Moreover, the monopoly sector is protected by the government. The implementation of new policies encouraged the monopoly sector to become strong in the 2000s, which increased discrimination against migrants from 2002 to 2013. To reduce the influence of the monopoly sector in the urban labor market, a set of ownership reforms, such as SOEs ownership reform, deregulation of entry to the monopoly sector for privately-owned enterprises and foreign-owned enterprises, should be implemented by the Chinese government.

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