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The evolution of the wage gap between rural migrants and the urban labour force in Chinese cities*

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An increasing earning gap between rural migrants and urban residents has recently aroused public concern about rising urban poverty asscociated with migration of rural people into Chinese cities. To address the issue, this paper explores the possibility of wage assimilation for rural migrants towards their urban counterparts and its determinants between 1999 and 2009, by applying an economic assimilation model to analyse a repeated cross-sectional data for seven Chinese cites at the individual level. The results show that rural migrants' earnings do not assimilate to their urban counterparts, although the situation improves gradually over time. This implies that institutional and policy barriers impede the assimilation process of rural migrants, which supports the call for further labour market reforms.

Key words: institutional barriers, rural-to-urban migration, wage assimilation.

1. Introduction

Large-scale rural-to-urban migration is one of the most significant phenomena in China's labour market over the past four decades. Motivated by the large and growing earning gap between the rural and urban sectors, millions of Chinese labourers left their villages and looked for work in cities since the late 1980s (Meng 2000; Zhao 2000). By 2017, there were around 172 million rural-to-urban migrants working in cities, which accounts for over 40 per cent of the Chinese urban labour force (NBS 2017). This is known as the biggest voluntary migration ever in human history.

Although rural migrants have made a significant contribution to Chinese economic growth, they have suffered from discrimination in the labour market of the host cities. Many previous studies have found that rural migrants were disadvantaged in earnings and occupational attainment compared to urban workers in cities (see Meng 2001; Meng and Zhang 2001; Zhao 2003; Du *et al*. 2006; Park and Wang 2010). This is mainly due to

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the 'guest worker system' put in place by the Chinese government for rural citizens, under which rural migrants usually hold a temporary work 'visa', restricting rural-to-urban migrants from attaining urban residency status (Du *et al*. 2006).

Various institutional and policy barriers have long restricted the employment and earnings of rural migrants. The increased disparity between rural migrants and established urban populations may lead to social instability and threaten social security. Hence rural to urban migration has become a major concern to city governments. Many studies emphasise that rural-to-urban migration contributes to the rising crime rates in China (Zhang 2011; Zhang *et al*. 2014; Zhang *et al*. 2018). The institutional restrictions and discriminatory policies towards rural migrants diminish their living standards in cities, and it is possibly increases their propensity to enage in criminal activiity (Zhang *et al*. 2018).

Therefore, it is very important to understand how rural migrants perform in the urban labour market over time relative to their urban counterparts. Understanding their earnings over time may provide important policy insights for city governments. However, few have attempted to examine rural migrants' wages from a dynamic perspective due to a lack of methodology and suitable data. To answer these questions, this paper applies an economic assimilation model (Chiswick 1978; Borjas 1985, 1995) to analyse the repeated cross-sectional data (combining different data sources). The purpose is to track the dynamic change in relative wage between rural migrants and urban residents in seven Chinese cities between 1999 and 2010 and explore the possibility of wage assimilation for rural migrants towards their urban counterparts.

According to the economic assimilation theory of migration, immigrants usually earn less than the native-born upon arrival, but this earning gap can erode with time spent in the host region. As immigrants first arrive, they usually suffer from lack of local experience, such as years of schooling and work experience and so are disadvantaged in the local labour market. However, when they stay for a longer period, accumulation of country-specific human capital, such as job-specific training, language, knowledge of culture and customs, can help them to overcome the market discrimination, making them comparable with their local counterparts (Chiswick 1978). The rate at which the gap narrows is usually interpreted as a measure of economic assimilation (Meng and Gregory 2005). Consistent with the theory, a large number of empirical studies on international migration in developed countries have provided supportive evidences: immigrants (including both skilled and unskilled immigrant groups) could assimilate with and finally catch up to their native counterparts with length of time residing in the host region increases (see Chiswick 1978; Borjas 1985, 1995; Friedberg 1992; LaLonde and Topel 1992; Baker and Benjamin 1997).

This study is based on economic assimilation theory and the empirical results obtained in developed countries (Chiswick 1978; Borjas 1985, 1995; Friedberg 1992; LaLonde and Topel 1992; Baker and Benjamin 1997). Using

the data on international migration in developed countries, evidence has been found that immigrants (including both skilled and unskilled immigrant groups) could assimilate with, and finally catch up with the natives as the length of time residing in the host region increased. However, little is known about whether the economic assimilation theory can explain wage changes for internal migrants in a developing country, like China. In particular, questions still remain on whether rural migrants catch up with their urban counterparts economically, when there is discrimination from government policies.

The results show that a growing gap in average wage between rural migrants and urban workers. Rural migrants' wages generally do not assimilate to those of their urban counterparts. This finding means that rural migrants in Chinese cities should not be regarded as equal to their urban counterparts in terms of lifetime earnings. Moreover, when separating into different groups, rural migrants perform heterogeneously in the economic assimilation process. Specifically, less educated rural migrants and those residing in capital cities seem to have an advantage in the assimilation process. This implies that China's urban labour market tends to favour less educated rural migrants, which in turn may encourage rural immigrants (in particular, male) to invest less in their human capital.

Is study makes three contributions to the literature. First, it is the first attempt to use the economic assimilation model to analyse changes in rural migrants' wages in urban China from an empirical perspective. Second, the propensity score matching method (Rosenbaum and Rubin 1983) is employed to base the comparison between rural migrants and urban workers on a sample with similar characteristics. This helps to resolve the 'lack of common support' problem associated with the traditional economic assimilation model. Third, the year effect (which is used to capture wage assimilation speed) is decomposed along with other independent variables. Such a treatment allows for the consideration of more flexible years of arrival effects and relaxes the 'constant year effect' assumption, compared with the traditional economic assimilation model.

The rest of this paper is organised as follows. Section 2 discusses rural-to-urban migration and its effects on wage inequality, and reviewes relevant relevant recent Chinese literature. Section 3 describes the data, and Section 4 shows some summary statistics. A migrants/urban worker wage comparison will be conducted in Section 5, and the decomposition method is adopted to reveal the main factors accounting for the dynamic change in wage gap. Section 6 discusses the common support problem when comparing two groups of workers, models specifications of the economic assimilation model and their corresponding regression results. Section 7 concludes the paper.

2. Rural-to-urban migration and dynamic wage differences in urban China

For a considerable period (which extends back before 1978) China has followed a policy of 'sacrificing agriculture and subsidising industries' as part

of its development strategy. To fulfil this strategy, population mobility between rural and urban areas was strictly controlled since the early 1950s (Zhao 2002). As a consequence, the rural and urban economies were isolated for about 40 years, through implementing the household registration system (i.e. *Hukou* System). Despite their different attitudes towards the population mobility control policy, most previous studies on rural-to-urban migration agreed that the strict enforcement of rural-to-urban migration controls has contributed to segregate between the urban and rural labour markets and created an institutional bias towards urban residents between the early 1950 and the end of 1980s (Lin *et al*. 1996; Cai 2001; Zhao 2002; Cai and Wang 2004).

However, as economic reform was initiated in the late 1970s, millions of rural labours were released from agricultural production. Since labour mobility was tightly controlled by the *Hukou* system until the middle 1980s, these redundant rural workers were originally absorbed by the rural non-agricultural sector. However, during the early 1990s, the rapid growth development of the urban economic sector, especially the private and informal sectors, created demand for rural labour in urban areas. Thus, both supply and demand forces pushed the Government to relax the restrictions on rural-to-urban migration (Meng and Zhang 2001). As a result, the population mobility control lost its initial effectiveness and the rural and urban labour markets began to link to each other. Attracted by relatively higher urban incomes, millions of rural workers flowed into the cities.

Although the strict restrictions on population mobility between rural and urban areas have gradually relaxed, rural migrants in urban China are still treated differently from their urban resident counterparts. For example, until recently rural migrants only had temporary permission to work in a host city with no access to the social benefits available to their urban counterparts. As a consequence, these migrants have had to work in long-hours-low-payment jobs and so are not a substitute of urban resident workers in the urban labour market. The institutional arrangements created significant inequality in employment opportunity and income between the two groups of workers in the Chinese urban labour market.

Many studies have investigated the income disparity between rural-to-urban migration and urban residents in China (see Meng 2001; Meng and Zhang 2001; Zhao 2003; Du *et al*. 2006; Park and Wang 2010). Most found that there is a significant difference in occupational attainment and wages between rural migrants and urban residents.

Meng (2000) and Meng and Zhang (2001) find that the wage inequality between rural migrants and urban residents is mainly due to occupational segregation. Meng (2000) suggests a two-tier labour market exists in China featured by typical urban residents working in higher-ranked jobs with higher wages, and more government subsidies, relative to rural migrants. For example, migrant workers as an excluded group are usually hired in low-income and unwanted 3-D jobs, that is dirty, dangerous and disgraceful tasks. There are also significant wage differentials between urban residents and rural

migrants. Using survey data in Shanghai from 1995 to 1996, Meng and Zhang (2001) further explored occupational segregation between rural and urban workers. They show rural migrants are much less likely to obtain white-collar occupations than their urban counterparts.

Later, Du *et al*. (2006) find that rural migrants are only allowed to stay in cities temporarily rather than settle down permanently. This study describes rural-to-urban migrants' usual objective as being to earn more and save as much money as possible before returning home. Accordingly, rural migrants have a short-term focus. Using two different data sources in Chinese cities from 2001 and 2002, Du *et al*. (2006) explored the impact of the 'guest worker system' on the well-being (such as earnings and health) of migrant workers in urban China. They found more migrants live in poverty than urban residents and migrants work 50 per cent more hours per week than their urban counterparts. This may reduce migrant poverty in the short run but may also adversely affect their long-term health condition. Park and Wang (2010) also focus on the influence of rural migrants on urban poverty and inequality in China. Contrary to the results of Du *et al*. (2006), using data from 12 cities in 2004 and 2005, they find relatively small differences in the poverty rates of rural migrants and urban residents. They explain this as owning to higher labour force participation rates and longer hours worked by migrant households. Their study shows the significant differences between migrants and urban residents are their non-income benefits and accessibility to social welfare systems.

Although previous studies contribute to improve the understanding of the income disparity between rural migrants and their urban counterparts from a comparative static perspective, few have addressed the issue from a dynamic perspective which leaves room for this study.

3. Data and summary statistics

The data for this study was obtained from the China Household Income Project Surveys (CHIPS) of 1999 and 2002, conducted by the Institute of Economics at the Chinese Academy of Social Sciences. Each survey was conducted independently, and covers 13 cities (in six provinces) in 1999 and 28 cities (in 12 provinces) in 2002, respectively. To extend the sample period to the most recent years, I also adopt the Flowing Population Monitoring Survey (FPMS) in 2010 conducted by the National Health and Family Planning Commission of China. This survey focuses on rural migrant populations in cities and covered 106 cities in China. The corresponding urban workers' data was taken from an Urban Household Survey (UHS) conducted in 2009 by the National Bureau of Statistics in 174 cities. As the 2009 UHS is the latest available data, I have to compare rural migrants in 2010 with urban workers from a year earlier.

All the three surveys cover a large random sample of households for urban residents as well as rural migrants, which were selected from the

corresponding population in each city. The questionnaires for urban residents and rural migrants are generally comparable, and the data collected from those surveys contain detailed employment and earning information for the sample. Meanwhile, some migration information such as 'year of arrival in the host city' and 'time spent in the host city' for rural migrants, which are crucial to the economic assimilation model, is also included.[1]

Since the main interest here is to compare the change in relative wages of rural migrants with those of their urban counterparts, only rural migrants and urban residents in the same cities should be tracked over time. Eleven of 13 and 28 cities were covered by CHIPS in both 1999 and 2002. Furthermore, when combining with 2009 UHS and 2010 FPMS data, only seven cities remain and have been chosen as the database. Those cities include five large cities (Beijing, Shenyang, Zhengzhou, Chengdu and Lanzhou) and two small to medium cities (Jinzhou and Pingdingshan), distributed across different regions of China.

Throughout the seven cities for all survey years, individuals are defined as those who hold agricultural *hukou*, employed and aged between 16 and 65. The sample for urban workers is restricted to those who hold non-agricultural *hukou* and for rural migrants to those who arrived in the host city at an age of 16 years or older.[2] Additionally, all observations with missing information (including missing values for earnings, year since migration and other important information) are deleted. Thus, the final data set contains 1,650, 768 and 4,775 observations for urban residents and 222, 403 and 3,803 observations for rural migrants in 1999, 2002 and 2009/2010, respectively.

Table 1 shows the descriptive statistics of urban residents and rural migrants by men and women in 1999, 2002 and 2009/2010. Some interesting facts, such as characteristics of migrant workers, changes in initial wages of rural and urban workers, and workers' mobility across occupations and industries, can be summarised as below.

First, rural migrants were less educated compared with their urban counterparts. As shown in Table 1, the migrants in the sample were on average 3–4 years less educated than their urban counterparts. Moreover, most of the migrant workers came into cities only after 1995, and the average length of rural migrants staying in the host cities has increased rapidly between 1999 and 2002 but tended to stabilise after 2002. On average, male migrant workers had resided in the host cities for almost 6 years in 1999, 8 years in 2002 and 7 years in 2010, respectively, whereas female migrants had 1 year less of duration in cities (almost 5 years in 1999, over 6 years in 2002 and 6 years in 2010). Around 50–88 per cent of male migrants and 64–92 per cent of female migrants arrived after 1995.

[1] As a repeated cross-sectional data set, our data set allows for the control of both 'years since migration' and 'cohort' effects when there is a need to take into account both quality of the cohort and assimilation effects.

[2] Note that 3 observations, which were recorded as having 15 years of schooling for migrants' workers, are dropped due to the limited observations.

Table 1 Summary statistics

	Urban workers			Rural migrants		
	1999	2002	2009/2010	1999	2002	2009/2010
Panel A: Men						
Monthly earnings (Yuan)	807.70 (615.69)	1,028.95 (674.74)	2,081.33 (2,099.88)	782.06 (693.70)	787.56 (682.99)	1,714.86 (3,427.20)
Years of schooling	11.33 (2.69)	11.26 (2.62)	12.99 (2.79)	8.77 (2.57)	8.42 (2.22)	9.30 (2.22)
Experience	22.97 (9.86)	24.17 (10.61)	23.48 (10.78)	18.30 (9.61)	22.09 (10.11)	19.32 (9.93)
Years since migration				5.70 (4.31)	8.26 (5.32)	7.21 (6.29)
%Cohort						
Before 1989				15.77	19.14	3.69
1990–1994				31.86	28.1	8.36
1995–1999				52.37	38.74	13.99
2000–2002				0	14.02	13.51
2003–2010				0	0	60.45
%Ownership						
State-owned	90.02	66.29	58.52	19.24	14.28	8.85
Private and individual(urban)	4.27	16.37	22.81	64.98	75.59	85.62
Joint venture and foreign invested	2.98	5.01	0	1.89	0.54	0
Private and individual(rural)	0.1	0.14	0	9.15	3.08	0
Other	2.64	12.19	18.67	4.73	6.5	5.54
%Industry						
Primary industry	4.08	2.37	5.02	0.95	0.48	4.84
Manufactory industry	37.43	41.35	23.84	14.2	9.73	12.28
Construction industry	5.47	7.34	4.56	5.68	4.07	12.95
Other secondary industry	11.85	14.12	14.81	3.79	4.51	0.41
Wholesale, retail and restaurant	6.96	13.93	13.56	43.85	42.81	42.53
Social service	4.65	10.2	11.17	20.82	22.75	14.84
Other tertiary industry	15.26	7.41	16.18	4.42	6.07	9.4
Government and social group	9.88	0.91	10.85	2.52	2.01	0.1
Other industry	4.41	2.37	0.01	3.79	7.58	2.64

Table 1 (*Continued*)

	Urban workers			Rural migrants		
	1999	2002	2009/2010	1999	2002	2009/2010
%Occupation						
Owners of private firms and self-employed	1.49	5.03	0	41.32	49.59	39.68
High-level officer	15.02	10.66	7.57	1.26	1.04	0.1
Professionals	23.08	14.39	25.49	5.99	5	13.03
Clerks	16.03	11.25	21.52	5.68	2.37	2.15
Unskilled workers	42.71	56.73	37.76	38.17	32.18	45.04
Others	1.68	1.94	7.65	7.57	9.82	0
%City						
Beijing	23.66	30.03	70.5	23.66	30.03	70.5
Shenyang	18.43	16.84	8.07	18.43	16.84	8.07
Jinzhou	9.12	21.27	2.6	9.12	21.27	2.6
Zhengzhou	10.75	7.8	5.77	10.75	7.8	5.77
Pingdingshan	9.74	4.62	1.5	9.74	4.62	1.5
Chengdu	14.54	10.2	7.76	14.54	10.2	7.76
Lanzhou	13.77	9.24	3.8	13.77	9.24	3.8
Number of observations	2,084	1,039	5,810	317	539	4,726
Panel B: Women						
Monthly earnings (Yuan)	665.95 (406.36)	743.25 (470.42)	1,594.09 (1,258.58)	539.29 (421.44)	605.52 (503.83)	1,292.31 (3,397.31)
Years of schooling	11.33 (2.56)	11.41 (2.44)	13.13 (2.61)	8.29 (2.45)	7.75 (2.38)	9.09 (2.49)
Experience	20.63 (9.38)	21.27 (10.06)	20.13 (9.75)	16.94 (9.68)	20.95 (9.13)	18.06 (9.96)
Years since migration				4.55 (3.27)	6.36 (4.22)	6.22 (5.52)
%Cohort						
Before 1989				8.56	6.6	1.67
1990–1994				27.93	27.24	6.34
1995–1999				63.51	44.29	12.5
2000–2002				0	21.86	12.33
2003–2010				0	0	67.16
%Ownership						
State-owned	89.82	58.75	47.12	16.22	12.55	6.38

Table 1 (*Continued*)

	Urban workers			Rural migrants		
	1999	2002	2009/2010	1999	2002	2009/2010
Private and individual(urban)	3.27	17.87	24.72	68.92	77.78	88.3
Joint venture and foreign invested	2.55	3.59	0	0.45	0	0
Private and individual(rural)	0	0.13	0	8.56	2.53	0
Other	4.36	19.65	28.16	5.86	7.14	5.33
%Industry						
Primary industry	2.97	1.08	2.76	0.9	0.89	2.66
Manufactory industry	35.94	30.78	13.91	10.81	9.67	9.46
Construction industry	4.42	3.1	1.68	0.9	0.85	1.83
Other secondary industry	8.79	7.68	7.19	1.35	0.66	0.39
Wholesale, retail and restaurant	11.7	20.87	22.1	49.55	51.31	59.46
Social service	7.88	22.14	17.25	22.52	25.55	18.37
Other tertiary industry	18.91	8.76	23.6	6.76	3.18	4.72
Government and social group	5.33	1.68	11.42	2.7	2.4	0.15
Other industry	4.06	3.91	0.08	4.5	5.49	2.96
%Occupation						
Owners of private firms and self-employed	0.85	5.89	0	38.29	50.93	40.18
High-level officer	6.67	2.01	2.92	0.45	0	0.08
Professionals	23.94	14.75	22.81	1.8	1.27	4.1
Clerks	19.52	17.67	26.77	4.5	2.06	2.21
Unskilled workers	46.97	53.32	40.07	44.59	38.7	53.43
Others	2.06	6.36	7.43	10.36	7.04	0
%City						
Beijing	22.24	30.73	70.85	22.52	17.37	14.86
Shenyang	19.94	19.66	8.13	19.82	18.86	13.91
Jinzhou	8.85	17.06	2.45	13.96	7.94	5.15
Zhengzhou	10.48	8.85	5.95	6.76	12.41	23.27
Pingdingshan	9.15	4.56	1.61	13.96	8.44	9.97

Table 1 (*Continued*)

	Urban workers			Rural migrants		
	1999	2002	2009/2010	1999	2002	2009/2010
Chengdu	15.82	8.72	7.33	12.16	22.58	19.41
Lanzhou	13.52	10.42	3.69	10.81	12.41	13.44
Number of observations	1,650	768	4,775	222	403	3,803

Note: Standard errors are displayed in parentheses. Data are weighted using sampling weights. 'Monthly earnings' are deflated into 1999 level using the CPI at provincial level.

Second, rural migrants earned significantly less than their urban counterparts in terms of both monthly earnings, and the gaps between the two groups widened over time. In 1999, the real monthly earnings for urban male workers were 808 Yuan, on average, while the amount for male migrants was 782 Yuan, which accounts for more than 97 per cent of that of urban workers. However, by 2010, the monthly earnings (in 1999 Yuan) of urban workers increased by roughly 158 percentage to reach 2,081 Yuan, while the number for migrant men increased by 119 percentage point to 1,715 Yuan. Hence, the ratio of rural migrants over urban residents has dropped to 82 per cent in 2010. Although female migrants' earnings were initially less than those of migrant men and urban female workers, the gap for annual earnings between them and their urban counterparts did not drop as much as for migrant men. The ratio of women migrants' wages to that of urban workers has remained constant at 81 per cent.

Third, there is significant segregation between rural and urban workers in types of firms, industry and occupation, though there was some change over time. For example, urban workers were mainly employed in the state-owned sector (59 per cent in 2010), whereas most rural migrants worked in urban private and individual sector (86 per cent in 2009). In terms of industry distribution, a round 24–41 per cent of urban male workers were employed in manufacturing industries, while 43–44 per cent of rural migrants are concentrated in wholesale, retail trade and restaurant, and another 15–23 concentrated in the social service sector. It turns out that rural migrants were more likely to work in tertiary industry than their urban counterparts. As for occupational distribution, most rural migrant men are either operating a small private enterprise, are self-employed (accounting for 40–50 per cent) or employed as unskilled workers (accounting for 32–45 per cent). On the other hand, urban workers were more likely to be high-level officers, professionals or clerks. These findings may suggest rural migrants and urban workers are segregated into two labour markets and that rural migrants can only access limited jobs in the host city.

However, this significant segregation between rural and urban workers is not sustainable in the long term along with market integration reforms. It seems that more urban workers and rural migrants were sharing similar jobs between 1999 and 2010. More specifically, from 1999 to 2010, one of the significant changes was that the frequency of urban workers in the state-owned sector fell from 90 to 59 per cent, with large-scale employment for urban male workers moving to the private sector, due to state-owned enterprises restructuring from the mid-1990s. In addition, more urban workers entered into tertiary industry and worked as unskilled workers. These facts reveal that unskilled urban workers, who had been gradually released from the state sector and exposed to labour market competitiveness and were likely to be competing with rural migrants.

Although there were growing gaps in monthly earnings between male and female migrants and their urban counterparts, they could possibly be caused

by differences in characteristics of the two groups of workers specific to cohorts, such as education levels and working experiences. To illustrate this point, the dynamic statistics of labour market outcomes according to 'year of arrival' (i.e. cohort) in host cities for men and women are presented in Table 2. This helps to provide a more thorough picture about the possibility of assimilation between rural migrants and urban workers. In this table, the change in average monthly earnings is compared from two aspects: across-cohort difference in each year or within-cohort difference across years. The table disaggregates migrants by five cohort subgroups. It shows that the monthly earnings appear to be higher for earlier than later cohorts in each year, which indicates the 'most assimilated' migrants will be those who have been in the host city the longest. Also, when tracking over the same cohort across years (i.e. within-cohort growth), the annual earnings for each cohort has increased.

4. Economic assimilation model: methodology and econometric issues

This section describes the economic assimilation model used to analyse the dynamic change in rural migrants' wages relative to their urban counterparts, and the econometric issues to be addressed.

4.1. Methodology and model specification

The standard economic assimilation model used either separated equations or a pooled equation as the basic model specification to examine the economic assimilation of international immigrants in developed countries (Chiswick 1978; Borjas 1985, 1995; Friedberg 1992; LaLonde and Topel 1992; Baker and Benjamin 1997). The major concern for choosing between the two methods is based on whether there is significant difference in the wage structures of new immigrants and local residents. Thus, the specification used starts with comparing the wage of rural migrants with that of urban workers.

Table 3 shows the estimation results from independent wage regressions for urban workers and rural migrants. The wage of rural migrants shows some

Table 2 Dynamic change in monthly earnings for rural migrants (Yuan)

	Men			Women		
	1999	2002	2010	1999	2002	2010
Before 1989	937.20	882.52	1,988.14	599.14	757.75	1,157.44
1990–1994	845.94	859.59	1,821.72	551.74	621.75	1,726.82
1995–1999	696.47	749.05	2,040.06	525.74	612.43	1,333.08
2000–2002	–	619.89	1,666.58	–	523.34	1,443.71
2003–2010	–	–	1,618.92	–	–	1,219.23

Note: Data are weighted using sampling weights. 'Monthly earnings' are deflated into 1999 level using the CPI at provincial level.

structure, which is different from that of urban workers. Furthermore, a Wald test is introduced by using a pooled wage regression that combines rural migrants and urban workers to justify the structural difference between the wages of rural migrants and that of urban residents from a statistical perspective. The test result shows that the coefficients for the two regressions in rural migrants and urban residents are significantly different, especially for the coefficients of experience (and its square term) and year dummy. Therefore, the method of separated equations is chosen as the baseline wage equations in analysing the rural-to-urban migration issue in China.

Following Borjas (1985, 1995), a standard wage assimilation model can be written as

Migrants' equation:

$$lnWage_{it} = X_{it}\beta_{rt} + \gamma_{r1}Exp_{it} + \gamma_{r2}Exp_{it}^2 + \kappa_1 YSM_{it} + \kappa_2 YSM_{it}^2 + \sum_{k=l}^{L} \pi_k COHORT_{ik} + \theta_{rt} YEAR_{it} + \varepsilon_{it}. \quad (1)$$

Urban workers' equation:

$$lnWage_{it} = X_{it}\beta_{ut} + \gamma_{u1}Exp_{it} + \gamma_{u2}Exp_{it}^2 + \theta_{ut} Year_{it} + \varepsilon_{it}, \quad (2)$$

$lnWage_{it}$ as the dependent variable is logarithm hourly earnings for each individual i (rural migrants or urban workers) at year t (1999, 2002 and 2009/2010). The independent variables comprise some control variables and measures of immigrant assimilation. The control variables in both regressions, X_{it}, include city dummies and several individual characteristics, such as years of schooling, and some employment features, such as occupation, industry and contract categories. The 'experience effect' is captured by Exp_{it} and its square term. Exp_{it} gives the worker's potential labour market experience, which is calculated as \$age-years of schooling-6\$. Hence, the potential working experience for rural migrants includes experience both in their hometown and in the host city. In the rural migrants' equation, the 'assimilation effect' is captured by the linear and quadratic form of YSM_{it}, which is identified by a cross-time variation deviation from the common time effect that is correlated with time since arrival. The cohort dummies ($COHORT_{ik}$) are defined by the year of arrival in the host city. It helps to sweep out the 'cross-sectional effect' (or arrival year effect). $Year_{it}$ gives the year dummy.

Equations (1) and (2) show the basic specification of the assimilation model, which specifies how the wage assimilation patterns of rural migrants will be determined in urban China. Two econometric problems should be discussed before regressions can be made – the common support problem and the identification problem.

Table 3 OLS estimation of earnings equations for men and women in 1999, 2002 and 2009/2010

	Dependent variable: log(monthly earnings in real term)					
	Urban workers			Rural migrants		
	(1) 1999	(2) 2002	(3) 2009	(4) 1999	(5) 2002	(6) 2009/2010
Panel A: Men						
Years of schooling	0.039*** (0.005)	0.055*** (0.009)	0.077*** (0.004)	0.068*** (0.019)	0.058*** (0.016)	0.038*** (0.004)
Experience	0.044*** (0.006)	0.057*** (0.007)	0.041*** (0.003)	0.035** (0.015)	0.024* (0.013)	0.026*** (0.003)
Experience squared	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	−0.001** (0.000)	−0.000* (0.000)	−0.001*** (0.000)
Constant	6.039*** (0.177)	6.021*** (0.220)	6.648*** (0.087)	5.115*** (0.550)	5.410*** (0.452)	7.165*** (0.081)
Observations	2,084	1,039	5,810	317	539	4,726
R^2	0.277	0.283	0.319	0.278	0.157	0.155
Panel B: Women						
Years of schooling	0.045*** (0.007)	0.038*** (0.013)	0.088*** (0.005)	0.067** (0.030)	0.048*** (0.016)	0.031*** (0.004)
Experience	0.042*** (0.006)	0.027*** (0.009)	0.035*** (0.004)	0.005 (0.023)	0.014 (0.013)	0.012*** (0.003)
Experience squared	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	0.000 (0.001)	−0.001** (0.000)	−0.000*** (0.000)
Constant	5.940*** (0.239)	6.489*** (0.330)	6.067*** (0.107)	5.530*** (0.545)	6.954*** (0.586)	6.805*** (0.091)
Observations	1,650	768	4,775	222	403	3,803
R^2	0.298	0.303	0.338	0.200	0.222	0.151

Note: ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level. Robust standard errors are displayed in parentheses below the coefficients. Other variables in the estimation include dummies for cities, ownership, industry and occupation categories.

4.2. Common support problem

One of the main concerns about making a comparison between two groups of different samples is the problem of 'lack of common support'. For the economic assimilation issue in urban China, it is necessary to consider that rural migrants and urban workers are quite different in terms of productivity-related characteristics and are segregated into two labour markets. For example, as described in Section 3, rural migrants are younger and less educated than urban residents. Some evidence indicates that there exists obvious occupational or industrial segregation between rural migrants and urban workers. An example is that most rural migrants are unskilled workers or self-employed and tend to collapse in tertiary industry, particularly in wholesale, retail and restaurant or social service. Urban workers, even if most are employed as unskilled workers, are more likely to be employed as high-level officers, professionals and clerks and are distributed evenly across industries. It turns out that the density for some characteristics (such as age, years of schooling, occupation or industry) in one group of workers (say rural migrants) may be close to zero where there is positive density in the other group (say urban workers), which implies a failure of the common support condition. Thus, comparisons between the two groups of workers (rural migrants and urban workers) without any adjustment for their different characteristics is problematic.

The typical treatment in literature is to ignore this 'common support' problem. The reason is that most international migration studies assume immigrants and local workers are homogeneous, since most host countries are migration countries (though this assumption is a bit strong). However, this 'common support' problem is not be ignored in this study since rural migrants are significantly different from urban workers when they first arrive in cities. Ignoring the common support problem may result in a biased estimation of the difference in labour market performance. To solve this problem, the propensity score matching method (Rosenbaum and Rubin 1983) is employed to identify the samples of urban workers corresponding to rural migrants.

More specifically, assume rural migrants are assumed to be the treatment group and urban residents as the control group. The propensity score is defined as the conditional probability of being rural migrants (say, treated) given pretreatment characteristics, such as age, years of schooling, health status and so on, and matched on the predicted probability of being a rural migrant between rural migrants and urban workers. This matched sample can then be combined for the purpose of comparison. The predicted probability of being rural migrants is a function of observed X, which can be written as:

$$p(X) = Pr(D = 1|X), \tag{3}$$

where $D = \{0,1\}$ is the indicator of exposure to treatment and X is the multidimensional vector of pretreatment characteristics.

Based on Equation (3), propensity scores are estimated for men and women in 1999, 2002 and 2009/2010 separately, using a logit model of whether an individual is a rural migrant. The dependent variable is a 0–1 variable denoting whether the observation is a rural migrant or not, and the independent variables include age, age squared, years of schooling, health status and a group of city dummy variables, chosen based on the concern of factors that may create the initial difference between rural migrants and urban workers. Thus, the predicted propensity scores for the 'common support' sample can be generated and saved. With the predicted propensity score, the data set can be trimmed for the economic assimilation analysis, with the condition that only rural migrants and urban workers with the same propensity are kept and used for comparison. The distribution of propensity scores for the trimmed sample is presented in Figure 1. In addition, I also perform the *t*-test on some key independent variables, including years of schooling, age, city dummies, occupation dummies and industrial dummies by each gender and year group. The results show that, although there still exists a significant difference between matched rural migrant and urban worker samples, there is no significant difference for the rest of key independent variables between rural migrant and urban worker samples.[3]

4.3. Identification problem

The other problem with the application of the economic assimilation model to analysing China's rural-to-urban migration is how to construct the identification condition for dealing with the 'inconstant' year effects in the wage equations of rural migrants and urban workers. In the traditional economic assimilation model, since year since migration, cohort and year are in perfect collinearity, the 'constant year effect' is usually assumed for two groups of workers as the identification condition to estimate the economic assimilation model. Two-stage regressions are adopted, so that year effect can be identified through estimating the wage equation of natives (urban workers) at first, and then fixing the year effect for immigrants (rural migrants) equal to that of natives (urban workers) to estimate both the cohort effect and year since migration effects in the immigrants (rural migrants)' equation.

However, for the case of China's rural-to-urban migration, this assumption might not be satisfied. This is because that year effects could be significantly different for rural and urban residents in their wage regression – significantly positive for urban residents but negative for rural migrants. For example, using Equations (1) and (2), the null hypothesis $\theta_{rt}^{'} = \theta_{ut}^{'}$ is rejected at the 1 per cent level. A possible explanation for this phenomenon is that relatively highly skilled urban workers in urban China may experience more significant wage growth over the period than less educated rural migrants. This raises the question of how to estimate the cohort effect and year since migration effects

[3] The testing results are available upon request.

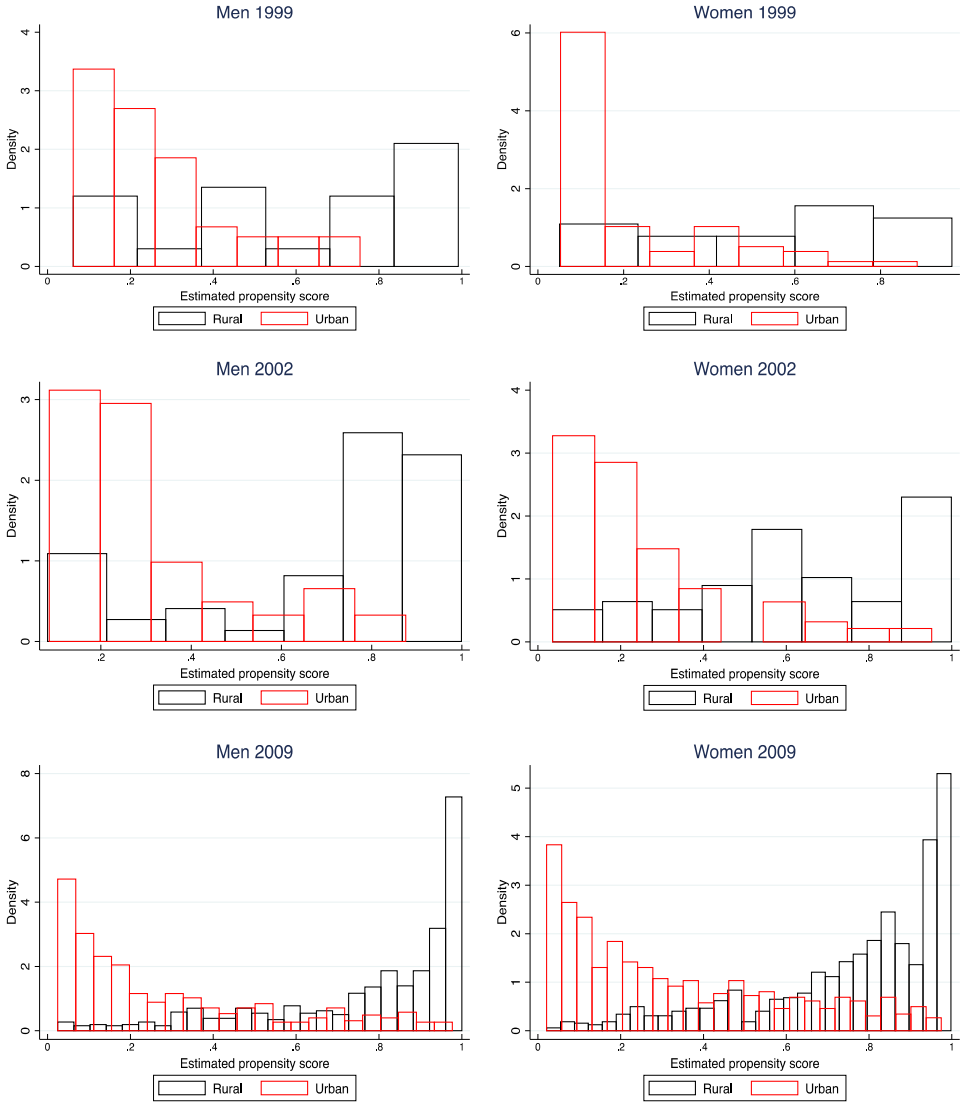

Figure 1 Distribution of propensity score for rural migrants and urban residents.
Source: Author's own calculation using data from 1999 and 2002 CHIPS, FPMS 2010, and 2009 UHS. [Colour figure can be viewed at wileyonlinelibrary.com]

of rural migrants when year effects are significantly different for the two comparative groups.

In this paper, I use two methods to deal with the identification problems. The first method is to assume that there is 'constant year effect' between the two comparison group while the second method is to construct a new identification condition by using interaction terms between year and some key variables in both regressions. In particular, for the second method, it is assumed that there are three factors, including years of schooling, health

status and city dummies, which play an important role in affecting the change in workers' wage over time. Additionally, it is also assumed that the residual year effect should be equalised between rural migrants and urban workers. Thus, Equation (1) for migrants and Equation (2) for urban residents can be re-arranged as below:

Migrants' equation:

$$\begin{aligned} lnWage_{it} = {} & X_{it}\beta_{rt} + \gamma_{r1}EXP_{it} + \gamma_{r2}EXP_{it}^2 + \kappa_1 YSM_{it} + \kappa_2 YSM_{it}^2 \\ & + \sum_{k=l}^{L} \pi_k COHORT_{ik} + \theta_{rt}^{'} YEAR_{it} + \theta_{rt}^{y} YOS_{it} \times YEAR_{it} \\ & + \theta_{rt}^{h} HEALTH_{it} \times YEAR_{it} + \sum_{k=p}^{P} \theta_{rtp}^{c} CITY_{ik} \times YEAR_{it} + \varepsilon_{it}. \quad (4) \end{aligned}$$

Urban workers' equation:

$$\begin{aligned} lnWage_{it} = {} & X_{it}\beta_{ut} + \gamma_{u1}Exp_{it} + \gamma_{u2}Exp_{it}^2 + \theta_{ut}^{'} Year_{it} + \theta_{ut}^{y} YOS_{it} \times YEAR_{it} \\ & + \theta_{ut}^{h} HEALTH_{it} \times YEAR_{it} + \sum_{k=p}^{P} \theta_{utp}^{c} CITY_{ik} \times YEAR_{it} + \varepsilon_{it}. \end{aligned} \quad (5)$$

From the Equations (4) and (5), the new identification condition can be derived given that the residual year effects should be equalised between the equations for rural migrants and for urban workers. That is,

$$\theta_{rt}^{'} = \theta_{ut}^{'}, \quad (6)$$

in Equations (4) and (5). So, the original identification condition,

$$\theta_{rt} = \theta_{ut}, \quad (7)$$

changes to the following new identification condition,

$$\begin{aligned} & \theta_{rt} - \theta_{rt}^{y} YOS_{it} - \theta_{rt}^{h} HEALTH_{it} - \sum_{k=p}^{P} \theta_{rtp}^{c} CITY_{ik} \\ & = \theta_{ut} - \theta_{ut}^{y} YOS_{it} - \theta_{ut}^{h} HEALTH_{it} - \sum_{k=p}^{P} \theta_{utp}^{c} CITY_{ik}. \end{aligned} \quad (8)$$

In choosing between the two identification conditions, the null hypothesis of $\theta_{rt}^{'} = \theta_{ut}^{'}$ is constructed and tested based on Equation (4) for migrants and Equation (5) for urban residents. The results show that it could not be

rejected at 1 per cent level, suggesting that the 'constant year effect' assumption is more favourable than the new identification condition.

4.3.1. Assimilation of rural migrants to urban workers in urban China
This paper examines the wage assimilation profiles between rural migrants and urban workers by using three scenarios, which include: the wage assimilation at the aggregate level; the wage assimilation for different time periods; and the wage assimilation for different groups of samples. Some selected results are reported in Tables 4 and 5. In each table, the first two columns present the results for men, and the last two columns present the results for women.

4.4. Wage assimilation at the aggregate level

Although the wage gap between rural migrants and their urban counterparts has increased over time, rural migrants' wage can still assimilate to those of urban workers with similar characteristics as the time of their residing in the host cities increases. Since the total potential experience has been controlled, the coefficient of year since migration (i.e. κ_1) in the wage equation of rural migrants measures rural migrants' additional benefits from the time residing in host city compared with time spent in the countryside. Combining the coefficient of YSM (κ_1) with the coefficient of Exp (γ_{r1}), the experience profile for migrants can be calculated – the slope of the wage profile. Furthermore, given that the coefficients of experience are different for rural migrants (γ_{r1}) and urban workers (γ_{u1}), the 'assimilation effect' thus can be derived as $\kappa_1 + \gamma_{r1} - \gamma_{u1}$, which can be described as the wage growth for migrants relative to their urban counterparts when time residing in the host city increases by 1 year.

Using the above calculation method and the regression results in Table 4, the assimilation effect can be estimated for men and women (when using the first-order term), respectively, as $0.021 + 0.023 - 0.044 = 0$ for men and $0.011 + 0.017 - 0.034 = -0.006$ for women. Given the first-order assimilation effect for men is zero or negative, rural migrants may not assimilate to their urban counterparts over time in the host city. Moreover, when distinguishing the economic assimilation of rural migrants by cohorts, the results show that there is no significant difference across years of arrival. This implies that recent wave of rural male migrants does not have a better initial situation in wage bargaining upon arrival than those belonging to the earlier waves.

Meanwhile, it is interesting that there are significant differences in return to education between rural migrants and urban workers and between rural/urban workers of different gender. In the model, the coefficients in front of year of schooling – a control variable to represent education levels – for urban workers are positive and significant at 1 per cent level, ranging from 0.067 to 0.073, which are greater than those for rural migrants, ranging from 0.033 to 0.040. In addition, the coefficient for rural female migrants is less than that for rural male migrants, which is the opposite to the pattern

Table 4 Estimation results from economic assimilation model

	Dependent variable: in log(monthly earnings real term)			
	Men		Women	
	(1) Urban workers	(2) Rural migrants	(3) Urban workers	(4) Rural migrants
Years of schooling	0.067*** (0.003)	0.040*** (0.004)	0.073*** (0.004)	0.033*** (0.004)
Experience	0.044*** (0.003)	0.021*** (0.003)	0.034*** (0.003)	0.011*** (0.003)
Experience squared	−0.001*** (0.000)	−0.000*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)
Year since migration		0.023*** (0.005)		0.017*** (0.005)
Year since migration squared		−0.001*** (0.000)		0 (0.000)
Cohort arrives 1990–1994		−0.032 (0.051)		0.022 (0.092)
Cohort arrives 1995–1999		−0.034 (0.058)		0.042 (0.100)
Cohort arrives 2000–2002		−0.086 (0.061)		0.029 (0.107)
Cohort arrives 2003–2010		−0.007 (0.065)		0.091 (0.109)
Year dummy for 2002	0.272*** (0.023)		0.168*** (0.028)	
Year dummy for 2009/2010	0.878*** (0.018)		0.843*** (0.021)	
Constant	5.834*** (0.099)	6.154*** (0.103)	5.690*** (0.142)	5.778*** (0.140)
Observations	8,933	5,582	7,193	4,428
R^2	0.555	0.154	0.538	0.150

Note: ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level. Robust standard errors are displayed in parentheses below the coefficients. Other variables in the estimation include dummies for cities, ownership, industry and occupation categories. In the rural migrant regressions, the year effects are fixed to be constant with those from urban workers' regression.

Table 5 Estimation results from economic assimilation model: by years, city scale, or education

	Dependent variable: log(monthly earnings in real term)			
	Men		Women	
	(1) Urban workers	(2) Rural migrants	(3) Urban workers	(4) Rural migrants
Panel A: for years 1999 and 2002				
Experience	0.047*** (0.005)	0.021** (0.010)	0.036*** (0.005)	0.018 (0.011)
Experience squared	−0.001*** (0.000)	−0.000** (0.000)	−0.001*** (0.000)	−0.001** (0.000)
Year since migration		−0.027 (0.017)		0.035 (0.022)
Year since migration squared		0 (0.001)		0 (0.001)
Observations	3,123	856	2,418	625
R^2	0.281	0.194	0.247	0.182
Panel B: for years 2002 and 2009/2010				
Experience	0.044*** (0.003)	0.020*** (0.003)	0.034*** (0.003)	0.011*** (0.003)
Experience squared	−0.001*** (0.000)	−0.000*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)
Year since migration		0.029*** (0.005)		0.018*** (0.006)
Year since migration squared		−0.001*** (0.000)		0 (0.000)
Observations	6,849	5,265	5,543	4,206
R^2	0.43	0.161	0.447	0.154
Panel C: for large cities (i.e. capital cities)				
Experience	0.045*** (0.003)	0.019*** (0.003)	0.033*** (0.003)	0.011*** (0.003)
Experience squared	−0.001*** (0.000)	−0.000*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)
Year since migration		0.030*** (0.006)		0.019*** (0.006)
Year since migration squared		−0.001*** (0.000)		0 (0.000)
Observations	8,033	4,631	6,536	3,725
R^2	0.541	0.165	0.522	0.149
Panel D: for small cities				
Experience	0.041*** (0.008)	0.025*** (0.006)	0.048*** (0.011)	0.006 (0.008)
Experience squared	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	0 (0.000)
Year since migration		−0.009 (0.011)		0.003 (0.014)
Year since migration squared		0 (0.001)		0 (0.001)

Table 5 (*Continued*)

	Dependent variable: log(monthly earnings in real term)			
	Men		Women	
	(1) Urban workers	(2) Rural migrants	(3) Urban workers	(4) Rural migrants
Observations	900	951	657	703
R^2	0.484	0.148	0.343	0.134
Panel E: for high school graduates				
Experience	0.047*** (0.003)	0.015* (0.008)	0.039*** (0.004)	0.022*** (0.007)
Experience squared	−0.001*** (0.000)	0 (0.000)	−0.001*** (0.000)	−0.001*** (0.000)
Year since migration		0.005 (0.012)		0.022* (0.013)
Year since migration squared		0 (0.000)		0 (0.001)
Observations	5,663	1,023	4,702	858
R^2	0.549	0.235	0.522	0.222
Panel F: for high school dropouts				
Experience	0.046*** (0.005)	0.022*** (0.003)	0.033*** (0.005)	0.009*** (0.003)
Experience squared	−0.001*** (0.000)	−0.001*** (0.000)	−0.001*** (0.000)	−0.000*** (0.000)
Year since migration		0.024*** (0.006)		0.015** (0.006)
Year since migration squared		−0.001*** (0.000)		0 (0.000)
Observations	3,270	4,559	2,491	3,570
R^2	0.397	0.145	0.287	0.138

Note: ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level. Robust standard errors are displayed in parentheses below the coefficients. Other variables in the estimation include dummies for cities, ownership, industry and occupation categories.

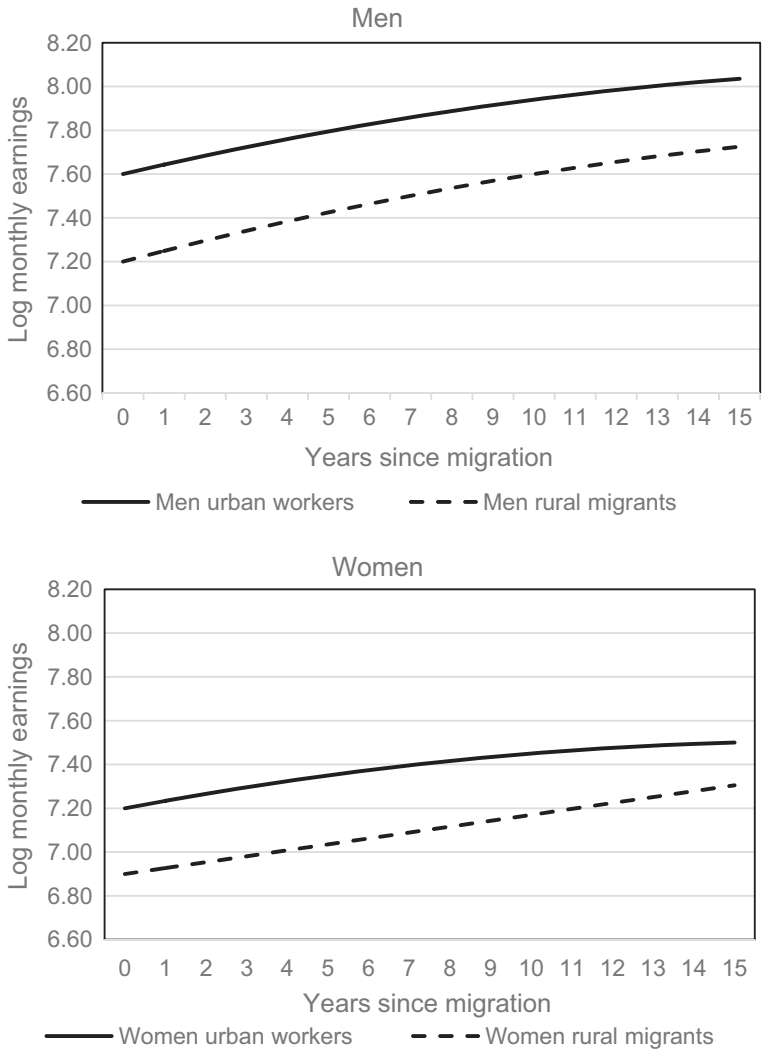

Figure 2 Earning profiles for rural migrants and comparable urban workers.
Note: The intercepts are calculated by picking the average log monthly earnings for those who are at 9 years of schooling, employed in private and individual sector, wholesale, retail and restaurant industry as unskilled worker in Beijing in year 2009/2010 in each group, and rural migrants are supposed to arrive in Beijing between 2003 and 2010.

between urban male and female workers. This suggests that urban workers have relatively higher return to education than rural migrants in Chinese urban labour market, and rural male migrants with relatively higher education level are more likely to be better paid compared to rural female migrants.

Based on the estimated year since migration and cohort effect in the regressions, the wage-experience profiles are drawn separately for men and women in Figure 2. The slope for urban residents is given by the coefficients of experience and its square term, while for rural migrants the slope refers to

the coefficient for *YSM* combined with *Exp*. The intercept in Figure 2 is calculated by using the average log monthly earnings for those who have 9 years of schooling in each sample, and employed in private and individual sector, wholesale, retail and restaurant industry and as an unskilled worker in Beijing. The gap for the intercepts between urban workers and rural migrants is the initial earnings differential between the two groups upon entry into urban labour market.[4]

Figure 2 illustrates the change in wage gap between rural male migrants and their urban counterparts over time in host cities for men and women. It shows that migrants earn less upon arrival than their urban counterparts for both the men and women samples. Since the first-order assimilation effect is about zero for both males and females, the wage gap between rural migrants and their urban counterparts does not diminish over time. This is evidence that rural migrant wages do not assimilate to comparable urban workers.

4.5. Wage assimilation by groups

How does the wage assimilation process between rural migrants and urban workers change over time and across regions, and differ between groups with different education levels? To answer these questions, the assimilation model is reused to examine the wage profile of rural migrants relative to their urban counterparts, when the whole time period is split and the total sample is regrouped according to the human capital of rural migrants and the city scale or administrative levels where they are residing.

First, when the whole sample period is split into two sub-periods (namely, 1999–2002 and 2002–2009/2010), the wage assimilation model can be used for each period. The coefficients in front of year since migration have changed from no statistically different from zero to positive and significant at 1 per cent level (see Panels A and B of Table 5). This suggests that rural migrants become more capable of assimilating to their urban counterparts over time.

Second, both male and female migrants are more likely to assimilate to their urban counterparts in large cities than in small ones, but these results may be due to the limited sample size for small cities. When the total sample is split into two subgroups including the large and small cities,[5] the assimilation model can be re-applied to each subsample. The results are shown in Panels C and D of Table 5. Generally, the assimilation effects for rural migrants are positive in large cities (0.005 for migrant male), compared with the negative effects in the small cities (−0.025 for migrant male and −0.048 for migrant female). The results lead to the conclusion that migrants residing in capital cities, who may face more work opportunities and less

[4] The initial wage differentials between urban workers and rural migrants may be due to lack of local-specific human capital for migrant workers or discrimination against rural migrants.

[5] Capital city is specified at both country level and province level. Among 7 cities in my sample, there are 5 capital cities, which include Beijing, Shenyang, Zhengzhou, Chengdu and Lanzhou and 2 medium/small cities, which include Jinzhou and Pingdingshan.

turnover rates within a certain occupation, tend to have more wage advantage in recover quickly from the initial low wage than those residing in other medium/small cities.

Third, male migrants with relatively lower education levels are more likely to catch up with their urban counterparts in wage compared to those with higher educated levels, especially for males. When the total sample is split into two subgroups which include those high school graduates and those high school dropouts, the assimilation model can be re-applied to each subsample. The assimilation effect for migrant men who have graduated from high school actually is −0.027 while that for migrant men who have dropped out from high school is about 0 (see Panels E and F of Table 5). This suggests that migrant men who have dropout from high school are able to assimilate to their urban counterparts while male migrants who have graduated from high school could not. As a consequence, the earning gap between urban and rural male workers will widen over time.

5. Conclusions

This paper uses the economic assimilation model to explore the evolution of rural migrants' earnings relative to their urban counterparts in China between 1999 and 2010. The results show that the wage gap between rural migrants and urban workers is growing in urban China, and the economic assimilation of rural migrants towards their urban counterparts is not being achieved. This result implies that there exists segregated labour markets for rural migrants and local workers in urban China which impedes the assimilation process of rural migrants. It also highlights the importance of relaxing the institutional restrictions towards rural migrants in urban labour markets. Over time as government gradually relaxed the regulation, rural migrants appeared to be in a better position to catch up to their urban counterparts relative to previous generations of migrants. This paper also finds higher educated rural migrants have even less advantage in wage assimilation processes than lower educated ones. This result implies that the investment in education cannot eliminate all institutional segregation between rural migrants and urban workers. Finally, the results show that location choice may affect the wage assimilation process. Generally, male migrants residing in capital cities assimilate more quickly with their urban counterparts than those with higher education and residing in small cities. These findings imply that economic agglomeration which provides more opportunities in labour market is crucial to facilitate economic assimilation between rural migrants and urban workers.

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