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Migration, Welfare Improvement and Urban Development in China

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Sanbai Sun
Chunhua Wang

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MIGRATION, WELFARE IMPROVEMENT AND URBAN DEVELOPMENT IN CHINA

SANBAI SUN

CHUNHUA WANG

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Project Leader: SUN Sanbai

Male, PhD, Regional and Urban Economics

Institute of Economics China Academy of Social Sciences

No.2, Yuetan Bei Xiaojie, Xicheng District

Beijing 100836, P. R. China

Tel: 86-13718590282; Fax: 86-10-68034153

Email: sunsb@cass.org.cn; sunsanbai@qq.com

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Abstract

The project team members have completed the research project wherein we have measured individual welfare, tested the effect of migration on welfare, considered the effect of city size on welfare and gotten interesting conclusions.

Firstly, based on Amartya Sen's capability theory, the authors used China family household survey data in 2010 (CGSS2010) and the method of fuzzy comprehensive evaluation to measure individuals' welfare.

Secondly, the research team tested the effects of four kinds of migration on welfare. The results showed that welfare of out-city migrants is significantly lower than residents who did not immigrate, and welfare of migrants who move in-city is significantly higher than others. There is a significant difference of welfare between migrants who did not have *Hukou* identity of the urban area they moved in and stayed. The welfare of migrants who got *Hukou* identity is higher than others. The propensity score match (PSM) method estimation results show that migration has a significant negative effect on welfare.

The estimate of city size showed that city size and welfare performance has an inverted U-shaped relationship, even when an instrumental variable was used. Results show that whether city size increased by one person or a million people, the welfare of non-migrants will increase in most cities, but the welfare of migrants will decrease in almost all cities, especially in the big cities in China. So migrants who move to big cities like Beijing will have lower welfare even though they maybe get higher personal income, and their choices are objectively "irrational".

Keywords: Capability; Migration; Welfare; Propensity Score Match; Urban Size

JEL classification: J31; J61; R23

1. Introduction

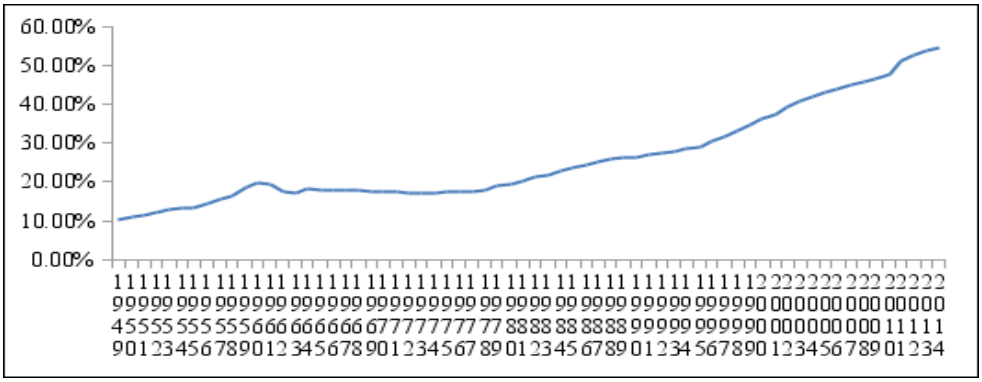
In 2006, the World Development Report of World Bank focused on equality and development. It analyzed inequality between and within countries, the economic and social impact of opportunity inequality, and showed how to achieve more fairness in politics and economic competition through public policies.[1] Since the reform of the 1970s, the regional economic development imbalances of China have increased among different provinces and cities and between urban and rural areas. One of the important causes of these imbalances is that people face different development opportunities in various regions. In 2013, in response to a reporter, the Chinese prime minister Li Keqiang said, "We must strive to ensure that everyone enjoys equal opportunity, whether they come from urban or rural area; regardless of their family background, they should obtain due repayment for their efforts".

To achieve this goal in China, a modification of social structure is needed to break the prevailing system of inequality. Chinese urban migrants (who migrate from rural to urban or between urban areas) experience strong external shock at the country's ongoing rapid urbanization. Since labor mobility is important in improving living standards of migrants and in attaining equal opportunities migration is very important in understanding urban development in China.

A large number of migrants from the Chinese countryside are forced to leave their hometowns during the urbanization process (Sun et al., 2012). After the rapid urbanization in recent years, Chinese population urbanization rate is 54.77 percent in 2014. According to the "Human Development of China 2013" which was released by the United Nations Development Program, Chinese urbanization rate increased from 10 percent to 50 percent in just 60 years, and in 2030 the urban population is projected to reach more than 1 billion, when the urbanization rate will have reached 70 percent.[2]

[1]WORLD BANK. World Development Report. 2006, (77).
[2] http://www.chinabgao.com/stat/stats/39263.html

Figure 1: The Urbanization Rate of China (1949-2014)



(a) Data in 1981 and prior years were taken from the statistics of household registration. Data in 1982, 1990 and 2000 were from national population census. Data in 1987, 1995 and 2005 were estimated based on the National one percent Population Sample Survey, and were estimated on the National Sample Survey on Population Changes in other years. Data in 1982-1989 and 1990-1999 were adjusted based on the National Population Census in 1990 and 2000, respectively.

(b) Total population and population by sex include the military personnel of Chinese People's Liberation Army, as military personnel are classified as urban population in the item of population by residence.

But, the structure of Chinese urban system is not optimal enough (Wang, 2010). Although the Chinese government has taken various policy measures to control urban size of some big cities (Wang, 2010), it seems that those various policy measures bring no substantial effect. It is important to find a better way to optimize Chinese urban structure. In order to investigate the spatial correlation of urban population and migrants in 2000 and 2010, we need to calculate the Moran index (Table 1).

The structure of the Chinese urban system is not optimal enough (Wang, 2010) Although the Chinese government has taken various policy measures to control urban size of some big cities (Wang, 2010), it seems that those various policy measures bring no substantial effect. It is important to find a better way to optimize Chinese urban structure. In order to investigate the spatial correlation of urban population and migrants in 2000 and 2010, we calculate their Moran index (Table 1).

The Moran index of Chinese population census in 2000 is less than in 2010, showing that the space correlation of permanent population has increased. The Moran index for migrants in 2000 was also lower than in 2010, showing that the space correlation of migrants in urban areas also increased. This result also can be seen in Figures 2 and 3.

Table 1
Moran index of urban population and migrants

year	urban population	Migrants
2000	0.3485	0.3122
2010	0.3962	0.3682

Figure 2: Moran index of migrants in 2000

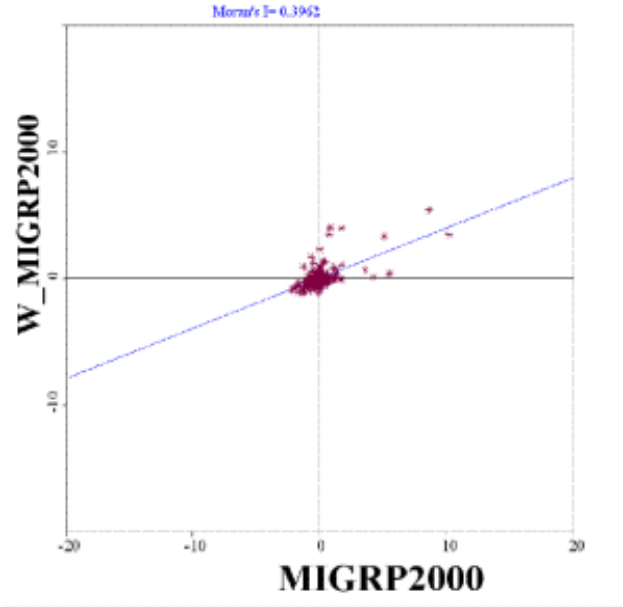
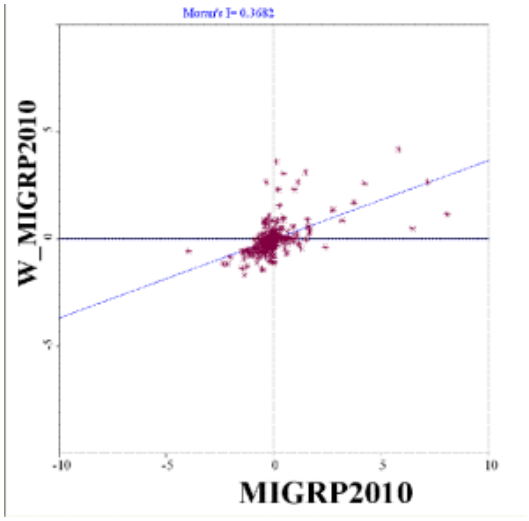


Figure 3: Moran index of migrants in 2010



Local Moran index was used to investigate the changes of permanent population agglomeration form 2000 to 2010. Compared to 2000, the urban population basically maintained low-low agglomeration in western China, but some cities in the Yangtze

river delta, the Pearl River delta or Beijing-Tianjin-Hebei region have high-high agglomeration totally; at the same time some cities in the middle west of China have high-high agglomeration or high-low agglomeration.

The spatial agglomeration patterns of migrants in many cities in central China are low-low agglomeration both in 2000 and 2010, which are net outflow cities; cities around them are also net outflow. Some cities like Beijing and Shanghai are high-high agglomeration showing these cities with net inflow. Cities around them are net inflow as well. It is worth noting that the number of cities that presented low-low agglomeration of migrants increased from 2000 to 2010.

Moreover, as environmental pollution and congestion increase, diseases are also becoming more prominent in big cities. Rapid urban expansion also brings a congestion effect (rising commute costs, environmental degradation, etc.) which could decrease migrants' welfare. In addition, urban expansion has other negative effects such as decreased comfort, high crime rate and steep housing prices. Wang (2011) pointed out that with the development of urbanization and urban expansion, problems such as environmental pollution, severe traffic jams and diseases occur more and more in big cities of China. These problems need to be resolved quickly. The welfare gap among urban residents - those individuals who have or do not have the *Hukou* identity of the city they live in - is obvious. The *Hukou* identity is linked to some kind of public resources in the urban area, such as education, medical and social security resources provided by urban administrations.

Thus, it is critical to know which cities are more suitable for migrants when discussing an optimal path of Chinese urban development. This project examines the influence of migration on welfare of original residents and new migrants of city size territories. It could help us understand the Chinese urban system more clearly, based on a new perspective, micro data and methods.

We have four major research questions.

1. What is the relationship between residents' welfare and income, age and other characteristics? What is the major difference of urban and rural residents' welfare within cities or between cities?

2. How do different types of migration (migration to city and migration out of city, migration with *Hukou* identity and migration with no *Hukou* identity) affect residents' welfare?

3. Does the relationship between city size and welfare in China fit Henderson's urban system theory? He pointed out that personal utility (a kind of welfare) and city size present an inverse U-type relationship (Henderson, 1974). We will use instrument variable (IV) to get a more reliable result than previous studies.

4. Lastly and most importantly, by the method of numerical simulation, we will discuss whether migrants' choices are objectively "rational" or "irrational". This will lead to several policy implications regarding urban population, migration and public services in expanding Chinese cities.

The results from this research will be provided for public debate on migration policy and Chinese urban systems for increasing migrants' welfare and promoting equality of opportunity in China. There are some specific policies related to our study: By analyzing which types of migration can improve residents' welfare, the government could guide migrants' choices by appropriate policy measures.

1. Help migrants choose the best cities by examining whether the behavior of migrants and their geographical space choices are "objectively rational"[3] or not. It would be useful to overcome the "inertia" of migration.

2. Give advice to the government about how to structure a better urban system to improve an individual's personal welfare and the welfare of Chinese people in total.

3. Strengthen the significance of urban management by fully understanding the relationship between city size and welfare.

4. Government could affect migration decisions through other related policies, for example, adjusting industrial policies and promoting the equalization of public services.

[3] Objectively rational means that migrants move into the city which can improve their welfare. We will investigate this topic in the next stage.

2. Literature Review

There are five lines of related literature. The first is on income and migration. Income, happiness and welfare index are mostly used by scholars who analyze welfare; it is also the same when one examines the relationship between migration and welfare. Classical theory tells us that income growth is one of the motivations that compel migrants to choose to move. On labor mobility and income growth, Axelsson and Westerlund (1998) found that labor mobility's impact on real disposable income was not significant in Sweden from 1980 to 1990. Rozelle et al. (1999) claimed that labor mobility has a dual effect on household agricultural production. The first is that labor mobility has a negative impact on crop output directly and significantly; the second is that out-work increased family income through remittance. Li (1999) argued that rural labor mobility not only improved migrants' household incomes directly or indirectly, but it also inhibited the rural residents' income gap to expand in the whole country, thus playing a positive role to alleviate the income gap between urban and rural residents. Frédéric et al. (2010) found that all European countries experienced a decrease in their average wages and a worsening of wage inequality because of immigration. Barro and Sala-i-Martin (1991, 1992, and 1995) found that speed of income convergence in America almost completely equals that of other countries; the reason may lie in the different degree of labor mobility. However, Evans and Karras (1997) did not get the same conclusion by using dynamic panel data; they found that America has a much faster income convergence speed than other countries. Braun (1993) showed that labor income convergence degree is proportional to labor mobility degree.

The second literature is about happiness and migration. Some scholars have studied the relationship between labor migration and happiness. Knight et al. (2009) estimated the relationship between subjective well-being and migration in developing countries, and pointed out that happiness of rural-urban migrants is at a lower level than of those residents staying in the rural areas. After controlling other variables in the case of migration, migrants exhibit a lower level of happiness, and the relationship

between happiness and income is stronger than in other groups (Bartram, 2011). Jiang et al. (2009, 2010) found that the influence of unequal income to happiness is different in various groups, a result which may be related to household registration. Sun and Bai (2014) pointed out that migrants who got *Hukou* did not reduce their happiness, but those who did not obtain *Hukou* may be seen as losing their happiness.

The third related literature is about optimal city size and urban structure. Standard urban economics theory points out that the optimal city size is formatted when the centripetal and centrifugal forces are at equilibrium. There has been a large body of literature which looks at optimal city size, but it is difficult to get a consistent conclusion. Capello (2000) argued that discussion of the optimal city size is insignificant, and the practical problems to resolve should be "effective city size" rather than "optimal city size". The effective city size is decided by the basic characteristics of urban organization on space. Of course, the existing studies tended to discuss optimal city size more than effective city size. Wang et al. (1999) quantified agglomeration effect and external cost, and argued that the best Chinese city size is roughly between 500 and 4000 thousand people by using different methods, with the peak position being basically between 1000 and 2000 thousand people. Using data of Chinese cities, Au and Henderson (2006) verified that real income per capita and city size performance has an inverted U-shaped relationship. Jiao (2012) found that the optimal city size changed with housing prices, ecological environment quality and government policies.

The fourth line of related literature is about city size and happiness. Delken (2008) investigated the residents of a recession-time German city in the sense of happiness, and found that although people worried about the city's economy, it did not affect their happiness. The reason could be is that people could withstand these challenges or perhaps those persons whose happiness had become low had already left the city. Ni et al. (2012) argued that Chinese urban happiness (or the average happiness of urban residents) shows typical club characteristics, and have nothing to do with urban per capita GDP, infrastructure and urban traits. Graham and Andrew (2006) claimed that people living in a big city have a lower level of happiness in 18

Latin America countries, but this effect is not significant. Jiang et al. (2012) divided Chinese cities into three grades according to urban non-agricultural population in 1990, and set up a dummy variable to control their influence (cities with more than 1.5 million non-agricultural population are defined as big cities), then found that people living in big cities report more happiness. Sun et al. (2014) found that happiness and city size present a U-type relationship, with the lowest point of the U-type curve representing about 300 million people in China.

The last line of related literature is the real relationship between migration, city size and welfare. Robert et al. (2001) estimated the welfare's effect on migration and revealed that welfare policy does indeed affect migration. There are some existing theories about the relationship between city size and welfare. From the perspective of literature of city size, Henderson (1974) pointed out that city size and typical residents' utility present an inverted U-type relationship. However, Henderson admitted that it is not so simple (Fujita et al., 2001). Based on numerical simulation, Xiao et al. (2011) found that city size and welfare performance have an inverted U-type relationship; the optimal city size increases with external scale economies expanding and crowded effect decreasing. Salau (1986) found that people living in a big city have a higher quality of life in Nigeria. Desmet and Esteban (2010) analyzed city size and its distribution from the perspective of efficiency, comfort and friction. The results show that the change of these factors impact on Chinese urban welfare far greater than in the United States. Xiao (2011) who built a new economic geography model, pointed out that welfare (real wages) and city size have an inverse U-type relationship; the optimal city size increases with the expansion of external scale economies and the decrease of congestion effect. However, the two articles did not use micro data to verify the relationship between city size and welfare.

3. Measurement of welfare

3.1 The method of welfare measurement

With reference to fuzzy mathematics approach, define the residents' welfare

function as fuzzy sets X, which subset W (belongs to a subset of X) is residents' welfare, $W \to [0,1]$, then the n resident's welfare function is as follows: $W^{(n)} = \{x, \mu_w(x)\} = \{w_1, w_2, w_3, \cdots, w_i\}$. Among them, $x \in X$, $\mu_w(x)$ is the membership degree of X, $\mu_w(x) \in [0,1]$. Generally set: the membership degree is higher, the welfare is better. Set x_i as primary indicators i of resident's welfare which decided by x_{ij}, then the primary index of residents' welfare as follows: $x = [x_{11}, \cdots \cdots, x_{ij}]$. Among them, $\mathrm{i} = 1,2, \cdots I$, I represents the function I of residents' welfare, $\mathrm{j} = 1,2, \cdots J$ represents the number of primary index of function I. Determine accurately the appropriate membership function is the key. Different indexes have different membership functions.

(1) The membership function of virtual variables as follows:

$$\mu_w(x_{ij}) = \begin{cases} 0, & x_{ij} = 0 \\ 1, & x_{ij} = 1 \end{cases} \tag{1}$$

(2) When the indicator is a continuous variable, its membership function can be defined as the following two forms:

$$\mu_w(x_{ij}) = \begin{cases} 0, & 0 \le x_{ij} \le x_{ij}^{min} \\ \frac{x_{ij} - x_{ij}^{min}}{x_{ij}^{max} - x_{ij}^{min}}, & x_{ij}^{min} < x_{ij} < x_{ij}^{max} \\ 1, & x_{ij}^{max} \le x_{ij} \end{cases} \tag{2}$$

$$\mu_w(x_{ij}) = \begin{cases} 1, & 0 \le x_{ij} \le x_{ij}^{min} \\ \frac{x_{ij}^{max} - x_{ij}}{x_{ij}^{max} - x_{ij}^{min}}, & x_{ij}^{min} < x_{ij} < x_{ij}^{max} \\ 0, & x_{ij}^{max} \le x_{ij} \end{cases} \tag{3}$$

x_{ij}^{min} and x_{ij}^{max} are the upper and lower limits of x_{ij}.

(3) For state variables (such as subjective well-being), assuming there are m kinds of

state, on this kind of status, usually set: $x_{ij} = \{x^{(1)}{}_{ij}, \cdots, x^{(m)}{}_{ij}\}$, define$x^{(1)}{}_{ij} < \cdots \cdots x^{(l)}{}_{ij} \cdots \cdots < x^{(m)}{}_{ij}$.

(4) The membership function for virtual qualitative variables as follows:

$$\mu_w(x_{ij}) = \begin{cases} 0, & x_{ij} \le x_{ij}^{min} \\ \frac{x_{ij}^{max} - x_{ij}}{x_{ij}^{max} - x_{ij}^{min}}, & x_{ij}^{min} < x_{ij} < x_{ij}^{max} \\ 1, & x_{ij}^{max} \le x_{ij} \end{cases} \quad (4)$$

a and b are the upper and lower limits of x_{ij}.

When considering the different effects of each indicator, it required on the basis of theory and the actual definition of different types of weight structure to reflect the role difference. Reference to Cheli and Lemmi (1995), the calculation method of the weights for the following:

$$w_{ij} = Ln[\frac{1}{\mu_w(x_{ij})}] \quad (5)$$

$\overline{\mu_w(x_{ij})}$ reflect the j index in i function of n resident, the computation formula is as follows:

$$\overline{\mu_w(x_{ij})} = \frac{1}{n}\sum_{p=1}^{n} \mu_w(x_{ij})^{(n)} \quad (6)$$

And then follow Ceriolli and Zani (1990) and Be´ Renger (2007), personal benefits of aggregation formula is:

$$W = \frac{\sum_{i=1}^{I}(\mu_w(x_{ij}) * w_{ij})}{\sum_{i=1}^{I} w_{ij}} \quad (7)$$

3.2 Data

Data for this research were mainly collected from a public service survey, namely, the 2010 China General Social Survey (CGSS), conducted by the sociology

department of Renmin University of China and the social survey center of Hong Kong University of Science and Technology. This survey was conducted in 2011. In the survey, about 11,785 respondents from 89 major Chinese cities of 31 provinces were included. From the interviews, we obtained data on the respondents' annual income, educational attainment, age, political status, gender, occupation, housing, index of media, car ownership, medical insurance, vote, happiness, health, etc. Table 1 presents summary statistics for some of the variables. We believe that the data is of high quality. Response rate is quite high.

Research material on welfare economics may be adequately found. The most popular idea in experimental research comes from Amartya Sen (2002) whose capability theory give us a new direction and five kinds of instrumental freedom, namely: (1) political freedom; (2) economic facilities; (3) social opportunities; (4) transparency guarantees; and (5) protective security. These five instrumental freedoms reflect individuals' welfare to a large extent. According to Sen's theory, Lv and Fang (2011) discuss the relationship between functions, capabilities, and welfare. Furthermore, Gao et al. (2007) pointed out that abilities cannot be directly observed, so welfare measurement is usually based on the functional activity. Sen's five instrumental freedoms can extend individuals' capability directly. Previous studies in developed countries generally select five functional activities to measure personal welfare, including living conditions, health, education and intellectual, social, psychological status. Some studies also chose labor market status and family economic resources (Martinetti, 2000). These freedoms are different among new migrants and original residents, and then take different changes in welfare to different kinds of residents.

Based on data availability and previous studies, we tried to select of all kinds of indicators to reflect capability as fully as possible; the selected indicators can be classified into five categories, namely: (1) economic conditions; (2) living conditions and lifestyle; (3) social security; (4) political freedom; (5) social opportunities and health, including mental health.

Table 2

Summary statistics

	Non-Migration		Migration		T Test
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Personal annual income	0.674	0.851	1.218	4.690	-6.323
Family's annual income per capita	0.692	0.822	1.210	4.667	-6.070
Area of house	*107.4*	*63.82*	*95.82*	*62.93*	*6.058*
House number	1.121	0.497	1.119	0.657	0.125
House owner	*0.776*	*0.417*	*0.599*	*0.490*	*13.19*
Getnews	2.226	0.732	2.510	0.740	-12.81
Car owner	0.0951	0.293	0.183	0.387	-8.854
BMI	2.576	2.170	2.546	2.016	0.466
Health	3.756	1.072	3.928	0.971	-5.489
Medicare dummy	*0.907*	*0.290*	*0.844*	*0.363*	*6.641*
Oldcare dummy	0.468	0.499	0.510	0.500	-2.789
Vote	*0.572*	*0.495*	*0.345*	*0.476*	*15.38*
Voted	*2.521*	*0.542*	*2.250*	*0.570*	*16.21*
Suggestion adopt	2.579	1.071	2.567	1.061	0.360
Happy	3.765	0.861	3.817	0.810	-2.031
Income fair	2.793	1.234	2.828	1.249	-0.951
Seccess by luck mosty	3.124	1.150	3.332	1.103	-6.080
Seccess by hardwork mosty	4.416	0.721	4.382	0.779	1.517
Observations	3164		1677		

(1) Economic status index includes income (personal income in 2009 and family annual income per capita in 2009); living conditions which include the family housing area, house ownership (if owned by themselves or their spouses, then equal to one, or else equal to zero), and house number; media index which is a composite index calculated by the frequency of use of internet, television, newspapers, and so on; and car ownership.

(2) Social security index including "medical insurance", if they have health insurance, then index is equal to one, or else it is equal to zero; "endowment insurance" which is equal to one if they have it, or else equal to zero.

(3) Political freedom index including "vote last time", that is, if they voted the last time in the committee (village) election meeting then index is equal to three, if not, then it is equal to two; if respondents do not have voting rights, then index is equal to one; "have voted", that is, if they have voted in the committee (village) transition

election in the last three years, then index is equal to one, or else equal to zero; and "suggestion adopted" that the degree of whose suggestion could be adopted by the government.

(4) Social opportunity index reflects the respondents' subjective controllable degree of success that is their subjective judgment of claim that "most personal achievement is to strive for".

(5) Health, mental and psychological indexes including "happiness", that is the subjective well-being score; if extremely unhappy, then index is equal to one, less happy is equal to two, in between happy and unhappy is equal to three, more happy is equal to four, very happy is equal to five. A sense of fairness, namely the feeling of personal income, unfair is equal to one, nearly unfair is equal to two, generally unfair is equal to three, almost fair is equal to four, fair is equal to five. Health, that is, self-report of health status, is not healthy is equal to one, less healthy is equal to two, generally healthy is equal to three, healthier is equal to four, very healthy is equal to five. BMI which is constructed from the body mass index.

We divided migration into four kinds, out-city migration and in-city migration, with *Hukou* migration (obtain the *Hukou* of the city they move in) and without *Hukou* migration (fails to obtain the *Hukou* of the city they move in). Then, we compare the Kdensity of personal welfare and annual income (Figure 4 and Figure 5), and find that welfare of individuals that stay is more distributed in the middle side where welfare is nearer to 0.2 than migrants; income of individuals that stay is more distributed at the low side than migrants. But the curve of welfare and income is different.

Figure 4: Kdensity of welfare and income between migrants and non-migrants

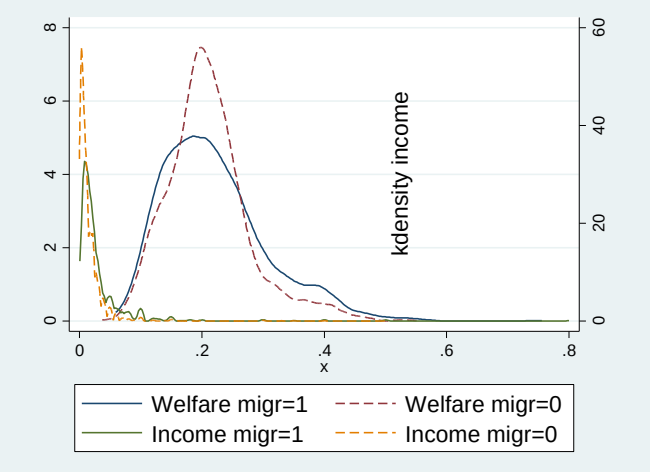
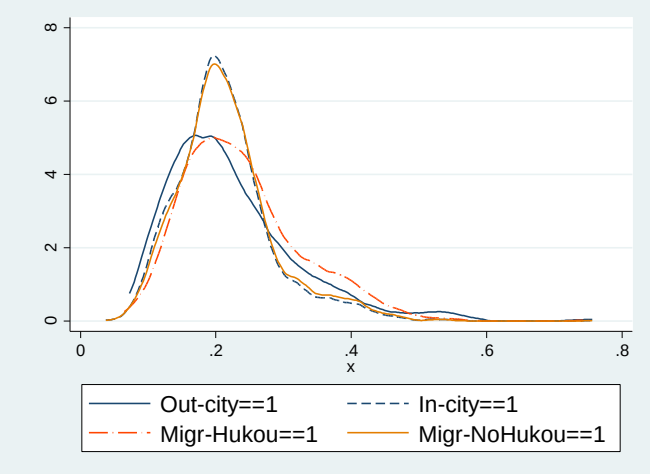


Figure 5: Kdensity of welfare between four kinds of migrants



Welfare of individuals who migrate in-city is more concentrated in the middle side where welfare is nearer to 0.2 than individuals who migrate out-city; welfare of individuals who migrate without *Hukou* identity of the city they move in is more distributed in the middle side where welfare is nearer to 0.2 than individuals who migrate with *Hukou* identity.

Table 3
Correlation coefficient

	Welfare	WelfareE	WelfareNO
Welfare	1		
WelfareE (include environment variable)	***0.999***	1	
WelfareNO (exclude house and car ownership variables)	***0.874***	0.876	1
Personal annual income	0.257	0.255	0.232

Family's annual income per capita	0.251	0.249	0.229
Area of house	0.280	0.281	0.302
House number	0.338	0.338	0.299
House ownership	0.225	0.223	0.153
Get news	0.333	0.333	0.276
Car ownership	0.642	0.642	0.208
BMI	0.0154	0.0161	-0.00920
Health	0.181	0.176	0.177
Medical care dummy	0.212	0.213	0.236
Old care dummy	0.347	0.346	0.356
Vote	0.481	0.480	0.639
Voted	0.354	0.352	0.477
Suggestion adopt	0.294	0.295	0.357
Happiness	0.309	0.308	0.313
Income fair	0.319	0.319	0.361
Success by luck mostly	0.189	0.188	0.222
Success by work hard mostly	0.0828	0.0849	0.125
Waste water per capital in the city	-0.00670	-0.0394	-0.0489
SO2 discharge per capital in the city	-0.0284	-0.0740	-0.0878
Smoke dust per capital in the city	-0.0329	-0.0781	-0.0852

We tested the correlation between welfare and its indicators (Table 3), and the results show that the highest correlation coefficient is between welfare and car owner, and the lowest one is between BMI and welfare.

4. Migration and welfare: From OLS to PSM

4.1 Econometric model and statistical

4.1.1 The Econometric model

This part mainly investigates the dummy variable of migration effects on individuals' welfare. Benchmark econometric model as follows:

$$Welf_i = \alpha_0 + \alpha_1 Migr_i + \alpha_i X_i + \mu_i \quad (8)$$

$Welf_i$ is individuals' welfare, $Migr_i$ is the dummy variable, on behalf of migration, if they immigrate, then it is equal to one, or else equal to zero. As control variables, X_i including age and its square, education, marital status and family

background variables. Following the method of Zhou (2010), we used propensity score matching (PSM) under the condition of control sample heterogeneity to study the effects of migration on welfare.

The PSM is used to estimate the effect of migration, the probability of migration for each sample, and the effect on welfare. Among them, the average treatment effect (ATE), average treatment effect on the treated (ATT), and average treatment effect on the untreated (ATU) are respectively:

$$ATT = E\ (Welf_{1i} - Welf_{0i} | Migr_i = 1) \quad (9)$$

4.1.2 Statistical

In this part, we mainly investigate the effect of migration on individual welfare of those who come from the rural areas or other cities, thus eliminating the samples who immigrate from urban to rural, and eliminating outliers and some samples with missing information of dependent variables needed to measure welfare, and keep individuals younger than 60, with the remaining 4841 data samples. In the available samples, 3,077 are in the city, 1,764 are in the rural areas; 1,677 samples are migrants, non-migrant samples are 3,164; out-city migrant samples are 421, in-city migrant samples are 1,256; migrants who get the *Hukou* identity are 666, and 1,011 migrants who do not get the *Hukou* identity of the city they move in.

The basic statistics of welfare index and its dependent variables (Table 4) show that the mean of residents' welfare based on capability is 0.201, the maximum and the minimum have a big difference, but with a relative small standard deviation; the mean age of our available samples is 42.66.

Table 4

Summary statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Welfare	4841	0.201	0.0625	0.0447	0.689
Migration	4841	0.346	0.476	0	1
Out-city migration	4841	0.0870	0.282	0	1
In-city migration	4841	0.259	0.438	0	1
Without *Hukou*	4841	0.209	0.407	0	1

With *Hukou*	4841	0.138	0.344	0	1
Male	4841	0.533	0.499	0	1
Age	4841	42.66	10.34	18	60
Education	4836	5.223	2.935	1	13
Father's education	4719	3.029	2.208	1	13
Mother's education	4793	2.362	2.136	1	14
Family status at 14 years old	4821	3.072	1.897	1	10
Urban sample dummy	4841	0.636	0.481	0	1

4.2 Empirical Results

4.2.1 Estimation of benchmark model

As the result of benchmark model, we use OLS to estimate the migration effect on individuals' welfare (Table 5). The result shows that after controlling for other variables, welfare of migrants and those who chose to stay have no significant difference. This conclusion is consistent with Wang and Chen (2010) to some extent. The results of other control variables show that: men's welfare is higher than women, age and welfare have an inverted U-shaped relationship, and education level has a positive correlation to welfare. Results of family background variables show that if the father's education is higher, or the mother's education is higher, or family status is better when respondents are 14 years old, their welfare is higher and thence family background has a significant effect on welfare. It is worth noting that the estimation of urban dummy variable suggests that the welfare of urban individuals is lower than rural individuals on average[4]. This is related to some studies on happiness, that happiness of rural residents is higher than city residents, such as Knight and Gunatilaka (2009), and Luo (2006).

Table 5

Migration and welfare（OLS）

Variables	OLS1 Welfare	OLS2 Welfare	OLS3 Welfare	OLS4 Welfare
Migration	-0.000			

[4] When we are going to investigate the difference between city residents and rural residents, the result shows that welfare has no significant difference whether in urban, so the main reason of city residents' welfare is lower than rural residents lies in the welfare of migrants is lower.

	(0.002)			
Out-city		-0.019***		
		(0.004)		
In-city		0.006**		
		(0.003)		
Without *Hukou*			-0.005*	
			(0.003)	
With *Hukou*			0.006*	
			(0.003)	
Out_*Hukou*yes				-0.014**
				(0.006)
In_*Hukou*yes				0.011***
				(0.004)
In_*Hukou*no				0.001
				(0.003)
Out_*Hukou*no				-0.021***
				(0.005)
Male	0.008***	0.008***	0.008***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)
Age	0.002***	0.002**	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
age2	-0.000*	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Edu	0.006***	0.006***	0.006***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
Dad_edu	0.001*	0.001*	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Mom_edu	0.001*	0.001*	0.001*	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
Clfort	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Urban	-0.016***	-0.018***	-0.014***	-0.016***
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	4,652	4,652	4,652	4,652
R-squared	0.200	0.209	0.202	0.210

Note: The estimators of marriage dummy variables and city dummy variables do not list. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

For a further study, the results show that relative to those who stay, the welfare of out-city migrants is significantly lower, but the welfare of in-city migrants is significantly higher. In addition, there is a significant difference between the welfare of migrants who failed to obtain the *Hukou* and stayed, from those who get the *Hukou*

who have a higher welfare than others. It means that migration patterns affect welfare in different ways.

We divided the available samples in to three kinds (the indigenous residents in the city, migrants, and rural residents), in order to identify the various welfare conditions between different residents (Table 6). The estimation results are different to the all sample estimations. In urban samples (including original city residents and migrants), migration has no significant effect on residents' welfare; but the welfare of out-city migrants were significantly lower than individuals who stay; the welfare of in-city migrants were significantly higher than individuals who stay (so the rural migrants' welfare is better than original urban residents); migration had no significant effect on welfare, whether or not an individual got *Hukou*. The estimates of rural resident and migrant samples show that the welfare of migrants is significantly lower than those that do not immigrate; the welfare of out-city migrants and in-city migrants were significantly lower than those that stay in rural areas, and the welfare of out-city migrants is lower than in-city migrants. Compared with the rural residents, the welfare of migrants who did not obtain *Hukou* were significantly lower, and the welfare of migrants who obtained *Hukou* have no significant difference to rural residents.

Table 6

Migration and Welfare

	(1)	(2)	(3)	(4)	(5)	(6)
Variables		Urban samples			Migrants and the rural samples	
Migration	-0.000			-0.014***		
	(0.003)			(0.003)		
Out-city		-0.021***			-0.035***	
		(0.004)			(0.004)	
In-city		0.007**			-0.011***	
		(0.003)			(0.003)	
Without *Hukou*			-0.005			-0.017***
			(0.003)			(0.003)
With *Hukou*			0.005			-0.004
			(0.003)			(0.004)
Observations	2,968	2,968	2,968	3,295	3,295	3,295

R-squared	0.194	0.206	0.196	0.239	0.251	0.243

4.2 .2 Robust test

We use different welfare variable to do a robust test. The first is welfare index with urban and city characters, and the second one is welfare without house and car ownership. The result did not change much, except the variable in-city migration and with *Hukou* migration.

Table 7
Migration and welfare（OLS）

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Welfare control urban characters			welfare not control house and car ownership		
Migration	-0.000			-0.003		
	(0.002)			(0.002)		
Out-city		-0.018***			-0.018***	
		(0.004)			(0.003)	
In-city		0.006**			0.002	
		(0.003)			(0.002)	
Without *Hukou*			-0.005*			-0.005**
			(0.003)			(0.002)
With *Hukou*			0.006*			0.000
			(0.003)			(0.003)
Observations	4,652	4,652	4,652	4,652	4,652	4,652
R-squared	0.205	0.213	0.207	0.182	0.190	0.183

Note: The estimators of marriage dummy variables and city dummy variables do not list. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.2 .2 The PSM method estimates

Now, we used the PSM method to estimate the effect of migration variables on welfare (Table 9). In the first step, the independent variables (i.e., a covariate) used to estimate the migration probability include age, gender, level of education, and family income per capital, born in city (dummy variable), mother's education level and job kinds.[5]

When using the PSM method, the covariate passed the balance test. For example,

[5] According to Nord (1998), age, gender, race, education, labor status, economic conditions, population characteristics, distance, and the early migration patterns, choice, climate, service facilities, and other quality of life factors influence on migration decisions.

the standard deviation (% bias) of all covariate of migration is less than 10% after matching, and the t test results do not refuse the hypothesis that there is no system difference between the treatment group and the control group. Compared to the stranded deviation before matching, the standardized variable bias greatly narrowed after matching. The standard deviation of the variables and the common value range of tendency to score are presented in Figure 6 and Figure 7 under the nuclear matching method. From Figure 6, the standardization of variable deviation narrowed after matching; from Figure 7, the scope of most observed values are within the common values (on the support), so just loss a few samples after matching.

Figure 6: Standardization of variable deviation

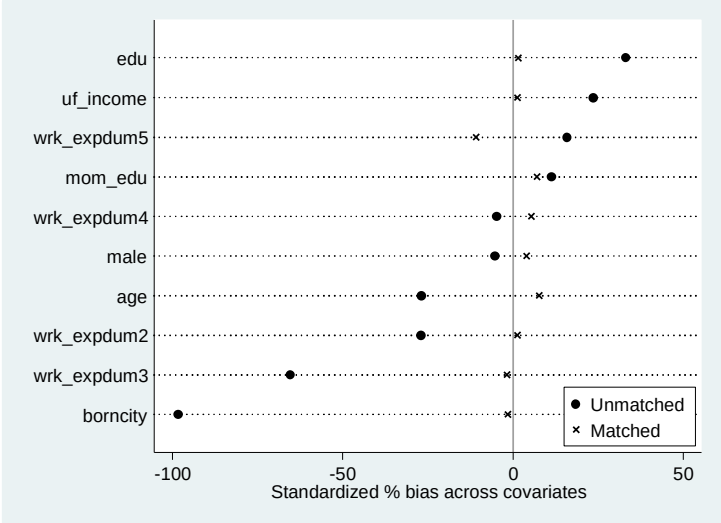


Figure 7: Common values scope of propensity score

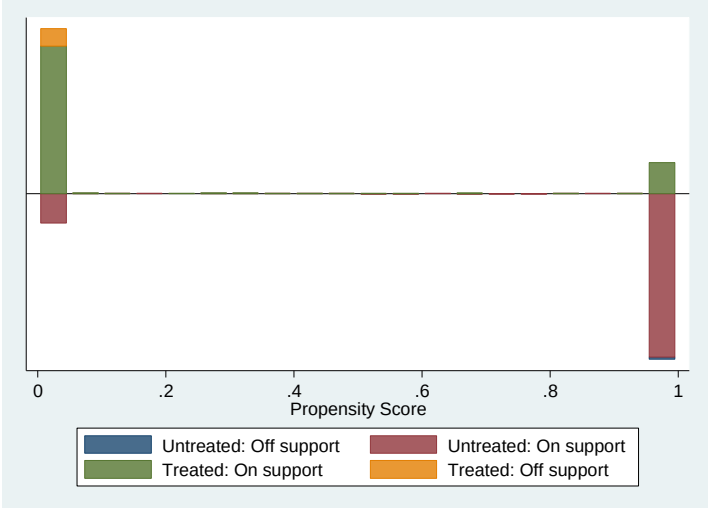


Table 8

P Test for PSM

	Mean			t-test	
Variable	Treated	Control	%bias	t	p>|t|
Male	0.537	0.517	4	1.080	0.279
Age	41.05	40.27	7.600	2	0.0460
Education	5.368	5.325	1.500	0.420	0.671
Family income per capital	0.857	0.840	1.300	0.410	0.682
Mom education	2.391	2.245	7	1.970	0.0490
Born in city	0.0643	0.0703	-1.500	-0.650	0.518
wrk expdum2	0.0404	0.0371	1.300	0.460	0.649
wrk expdum3	0.0520	0.0583	-1.800	-0.750	0.454
wrk expdum4	0.0280	0.0190	5.300	1.620	0.106
wrk expdum5	0.135	0.171	-10.80	-2.650	0.00800

When using the PSM method, sensitivity analysis is particularly important. Just as Rosenbaum (2002) divided selected bias into obvious bias and hidden bias, it is apparent that PSM has one major drawback, and that is that the hidden bias problems remain unsolved. There exists some important omitted variable that we may be unable to effectively control and match. In order to determine that the ATT estimates can be trusted, sensitivity analysis is needed (Yuan, 2015), which means we must investigate if the estimated results are sensitive for hidden bias or not. If the conclusion yields no significant Gamma factor at large values (often close to two), then the conclusion is tenable (Lin, 1997; Rosenbaum and Rubin, 1983).[6] This paper conducted three recessive deviation estimates (Table 9); the test results of migration of variable show that from one to two level, it reflects the sensitivity coefficient when gamma is two, or in short, PSM estimates of the data in the hidden bias can be ignored (sig- is lower than 10%); the estimate results based on PSM is credible.[7]

Table 9

Sensitivity analysis for PSM

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	-0.0238	-0.0238	-0.0277	-0.0199

[6] see an-ning hu (2012)

[7] Is limited to space, the migration of other types of variables through the sensitivity analysis of the related test, the results were not listed.

1.200	0	0	-0.0298	-0.0176	-0.0336	-0.0137
1.400	0	2.50e-09	-0.0348	-0.0124	-0.0387	-0.00835
1.600	0	0.000107	-0.0391	-0.00787	-0.0430	-0.00379
1.800	0	0.0339	-0.0429	-0.00391	-0.0468	0.000294
2	0	0.439	-0.0462	-0.000331	-0.0501	0.00396

The estimate results of the PSM method show that, compared with the individual with similar characteristics and does not immigrate, migration behave itself has a significant negative effect on migrants' welfare. This shows that the result of benchmark model (OLS) estimators of migration that welfare of migrants and non-migrants is the same, it is appearance after migration reduces migrants' welfare. Because migration promoted their income growth (Li, 1999), they want to change their income status through migration; as Mariapia (2008) found, people tend to associate labor migration with poverty and lack of resources which are actually a motivation of migration.

Table 10

Result of PSM

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Welfare	Unmatched	0.199	0.202	-0.00279	0.00190	-1.470
	ATT	0.195	0.215	-0.0199	0.00448	-4.450
	ATU	0.202	0.187	-0.0151	.	.
	ATE	-0.0166	.	.		

Note: In the match progress, we control the gender, age, education, mother's education, born in city, and job kinds. NN refers to the K neighbor matching, where K=4, the Kernel refers to nuclear matching, using the default Kernel function and bandwidth.

5. Urban Size and Welfare

5.1 Econometric model

Based on most of the existing welfare related research variables, the econometric model in this part investigated the effect of city size and its square on welfare. The main variables include: Welf_{ij} which is the welfare of individuals i in city j. U_j is

the city size which defined by the population size of the municipal district. As the urban area between cities is obviously different, even the cities with same city municipal district population scale have a different impact on the residents' welfare, as the effect of urban size on residents' welfare may also change with some other features of the city (population density, commuting cost, environment, etc.). Other factors that affect welfare include variables that reflect personal characteristics, defined as X_{ij}, including income, age and age square, gender, marital status and level of education. The effect of urban size may be different between migration and non-migration, therefore we add an interaction of dummy variable of migration with city size in the model with the urban size μ_j as province dummy variables, in order to control the impact of the same province to inner cities. The model is as follows:

$$Welf_{ij}=\alpha_0+\alpha_1 U_j^{\,2}+\alpha_2 U_j+\alpha_3 M_{ij}+X_{ij}'\beta+\mu_j+e_{ij} \qquad (10)$$

The regression of city size and province fixed effect variable are obtained by regression analysis of above, so we can calculate the effect of city size change on welfare of different individuals in the city (migrants or non-migrants). $Welf_{ij}$ is the welfare of resident i in city j, $Welf_{i0}$ is the welfare which is determined by the residents' own characteristics or other factors of the city. Thus $Welf_{ij}$ can be expressed as follows:

$$Welf_{ij}=\alpha_0+\alpha_1 U_j^{\,2}+\alpha_2 U_j + Welf_{i0} \qquad (11)$$

Without considering other changes of residents after migration (such as income, price, etc.), if the city size where the migrants lived in is different before and after migration, or the foreign migrants move in and change the city size of local residents,

use ΔU_j to reflect the range of the city size change, then the change of $Welf_{ij}$ is $\Delta Welf_{ij}$. Then, we construct the $\Delta Welf_{ij}$ measurement equation:

$$\Delta Welf_{ij}=\alpha_1 \Delta U_j^2+(2\alpha_1 U_j+\alpha_2)\times \Delta U_j \quad (12)$$

Furthermore, considering the effect of other factors after migration, if residents choose inter-provincial migration, the province fixed factors which have nothing to do with city size will change the welfare of migrants, make welfare change of individual i who move from m province to n province is $\Delta Welf_{imn}$ (e.g., the effect of income, housing, geographical environment and other factors), then measurement equation of $\Delta Welf_{ij}$ can be expanded as follows:

$$\Delta Welf_{ij}=\alpha_1 \Delta U_j^2+(2\alpha_1 U_j+\alpha_2)\times \Delta U_j+\Delta Welf_{imn} \quad (13)$$

5.2 Empirical Results

5.2.1 City size and welfare

In this part, we just keep the urban sample, and city size is defined by the population in the urban area. Because of missing variables, the OLS estimator may not be consistent, so we use instrument variables to test the effect of city size. The instrument variables are the urban population and its square in 1992. The population in 1992 is correlated to the population in 2010, but do not affect individuals' welfare in 2010. The test of instrument variable showed city size is a endogenous variable. The estimate of city size found that city size and welfare performance had an inverted U-shaped relationship, even with an investment variable in column (3). In column 1, we used OLS to estimate the effect of city size, and did not control province dummy variables, the estimators of city size and its square is significant on 1 percentage level, the result did not change in essence when we controlled province dummy variable in column 2. In column 3, we used instrument variables to estimate the effect of city size, the conclusion did not change. So the effect fit Henderson's urban system theory of city size and welfare to a certain extent.

Table 11

City size and welfare

VARIABLES	(1) Welfare	(2) Welfare	(3) Welfare
	OLS	OLS	IV
City size	0.002***	0.006***	0.019*
	(0.001)	(0.001)	(0.010)
City size square	-0.000***	-0.000***	-0.002*
	(0.000)	(0.000)	(0.001)
Migration	0.003	0.000	0.001
	(0.003)	(0.003)	(0.003)
Observations	3,011	3,011	2,678
R-squared	0.095	0.162	0.141

Note: The estimators of marriage dummy variables and city dummy variables do not list. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

5.2.2 Simulation

Now we use the estimator of province dummy variables in column (2) and column (3) in Table 11 to do a simulation work. The specific effect of province dummy variables is showed in Table 12. The control group is Anhui province in the OLS and IV estimation. Control other variables (in column 2), individuals live in Shandong, Guangxi, Jiangsu, Guizhou, Hunan, Heilongjiang, Sichuan, Shanxi1, Henan, Hubei, Qinghai, Hainan, Liaoning, Jilin, Gansu have lower welfare than Anhui and other province whose estimator of province dummy variable is insignificant.

Table 12

The fixed effect of province

Welfare	(1) OLS	(2) IV
Beijing	-0.037**	0.289
	(0.015)	(0.217)
Fujian	-0.026***	-0.019
	(0.009)	(0.013)
Gansu	-0.049***	*-0.082***
	(0.012)	(0.012)
Guangdong	-0.050***	-0.006
	(0.008)	(0.031)
Guangxi	-0.028***	*-0.025***

	(0.009)	(0.011)
Guizhou	-0.030***	*-0.029***
	(0.009)	(0.010)
Hainan	-0.064***	*-0.070***
	(0.018)	(0.018)
Hebei	-0.001	-0.005
	(0.012)	(0.012)
Henan	-0.045***	*-0.046***
	(0.008)	(0.008)
Heilongjiang	-0.060***	*-0.035***
	(0.007)	(0.017)
Hubei	-0.043***	*-0.046***
	(0.008)	(0.008)
Hunan	-0.041***	*-0.031***
	(0.008)	(0.013)
Jilin	-0.069***	*-0.076***
	(0.009)	(0.009)
Jiangsu	-0.024***	*-0.026***
	(0.007)	(0.008)
Jiangxi	-0.028***	-0.021
	(0.009)	(0.013)
Liaoning	-0.073***	*-0.074***
	(0.006)	(0.008)
Neimenggu	-0.029*	
	(0.016)	
Ningxia	-0.034**	-0.022
	(0.013)	(0.018)
Qinghai	-0.046***	*-0.046***
	(0.015)	(0.015)
Shandong	-0.020***	*-0.020***
	(0.007)	(0.008)
Shanxi1	-0.034***	*-0.036***
	(0.008)	(0.008)
Shanxi2	-0.007	0.003
	(0.008)	(0.013)
Shanghai	-0.022	0.481
	(0.023)	(0.336)
Sichuan	-0.031***	*-0.035***
	(0.008)	(0.009)
Tianjin	-0.059***	0.004
	(0.008)	(0.042)

Note: The estimators of marriage dummy variables and city dummy variables do not list. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Then we do some simulations to test the effect of city size change on welfare in

different cities (see Figure 8 and Figure 9), by using the estimators of city size and province dummy variables in column (3) in Table 11. We find that whether the city size increases by one person or a million people, the welfare of non-migrants will increase in most cities, but the welfare of migrants will decrease in almost all cities, especially in the big cities like Beijing in China. So migrants who move to Beijing will have lower welfare even though they maybe get higher personal income, and their choices are objectively "irrational".

Figure 8: The welfare change when increase one person

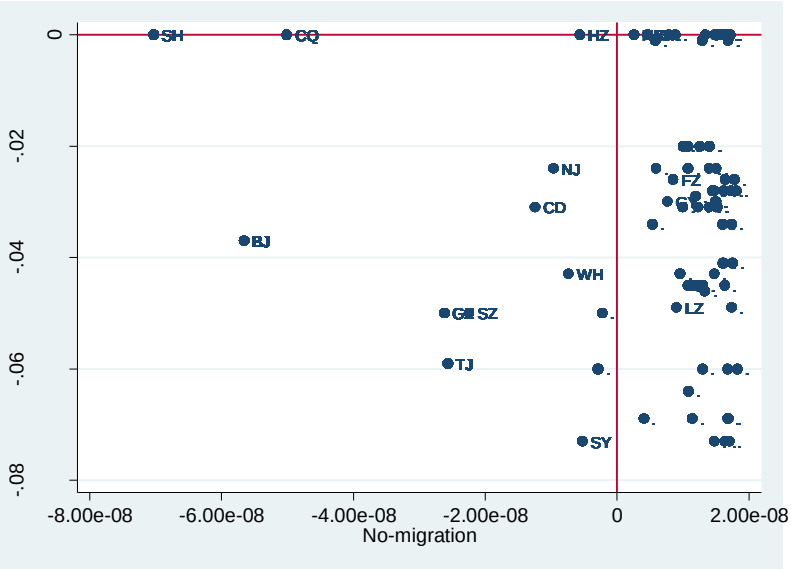
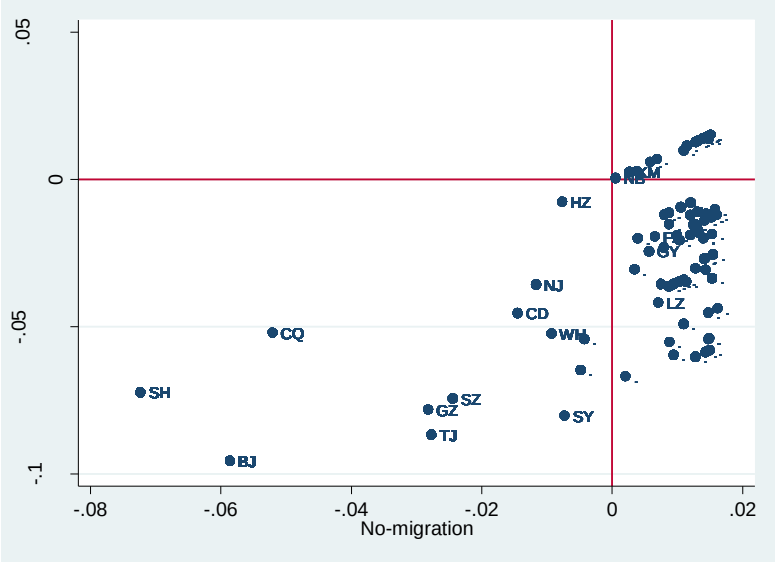


Figure 9: The welfare change when increase one million people



6. Conclusion and policy relevance

Based on the micro survey data of China in 2010 (CGSS2010), this project used three kinds of econometric models to test the effect of four kinds of migration on

individuals' welfare from the capability perspective. Our main conclusion is as follows:

We tested the effects of four kinds of migration on welfare. The results show that welfare of out-city migrants is significantly lower than residents who did not immigrate; welfare of migrants who move in-city is significantly higher than others. There is a significant difference of welfare among migrants who did not get *Hukou* identity of the urban area they moved and stayed in, and welfare of migrants who got *Hukou* identity is higher than others. Then, the propensity score match (PSM) method estimation results show that migration has a significant negative effect on welfare.

The study found that city size and welfare performance has an inverted U-shaped relationship, even when an investment variable was used. The simulation results showed that migrants who move to big cities like Beijing will have lower welfare even though they maybe get higher personal income, and their choices are objectively "irrational".

Therefore, to enhance migrants' personal welfare, the key is to break the welfare inequality related to *Hukou* system, and allow urban migrants to enjoy social security, education and other resources related to the *Hukou* system equally. Because migration could increase the income of migrants, but may not necessarily improve their welfare, it is important to consider more factors than income (such as social security, housing, etc.) when creating policies and measures designed to improve migrants' welfare. In short, increasing income through migration is easy to implement, but promoting welfare with increased migration is a challenge, even necessitating the breaking of institutional factors to avert adverse impact on urban migrants.

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