

Migration, Urbanization and Spatial Dispersion in China

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Abstract

This paper examines patterns of recent internal migration in China, with attention to implications for urbanization and spatial inequality. Using the micro-data of 0.95% sample of the China 2000 Census and adopting a multinomial statistical model, we study the main characteristics of non-migrants, temporary and permanent migrants. We look specifically at their origins and then their destinations across a range of the urban hierarchy: major metropolitan areas, other cities, small towns and rural areas. Based on the results of our statistical analysis, we simulate the major migration patterns by human capital of the migrants across urbanization categories. Our study is designed to help answer three questions: (1) how did the Chinese population redistribute across territory with respect to urbanization categories? (2) How did migration affect urban demographic structure? (3) Has migration contributed to the changes in regional disparities (by skill level) in the past and is it likely to cause further spatial inequality in the future?

Introduction

China has been undergoing rapid urbanization, fueled by extraordinary migration to urban areas. The pace and scale of change in population distribution is arguably unparalleled in any major population in the contemporary period. This has attracted a great deal of observation and commentary, both from demographers and a wider set of observers. We inform this discussion further by looking in more detail at the geographic distribution of those flows (origin-destination combinations) and at the demographic covariates that predict mobility and the choice of destination.

Simply due to scale, the urbanization of population in China is consequential for the world. The most recent United Nations report (estimates for 2007) counts 561 million urban dwellers in China, some 17% of the entire world's urban population. China, along with India, is expected to account for about a third of all urban population growth between 2007 and 2050 [UN, 2008]

The pace of urbanization in China is striking. In 1981, around the time of the onset of liberalized economic policy, China's population was recorded to be less than 30% urban. By 2007, the figure had grown to an estimated 42.2%. A large fraction of this urbanization -- the increase in the proportion of the population classified as residing in urban areas -- has been driven by basic demographic dynamics. According the UN, migration and reclassification accounted for around 70% of Chinese urban growth in the 1980s and some 80% in the 1990s [UN, 2008, p. 15]. While Chinese territory has undergone significant reclassification, there is also no question that the very low fertility rates, especially in China's large urban areas, under the one-child policy, make for a demographic dynamic in which migration contributes at extraordinarily high levels.

Such an overall population shift is imbedded in larger patterns of population redistribution. These are in turn linked to aspects of economic development, and thus, the form in which population redistribution operates may have consequences for regions and the people residing within them. Of particular interest is whether the contemporary pattern of Chinese population redistribution fits with a notion of movement up the urban hierarchy. As we discuss below, the empirical regularity of migration in the past (in most societies) is movement from smaller to larger places. This is almost a *sine qua non* of urbanization. The manner in which that net urbanward redistribution takes place may differ substantially however. In one case movement may be in relatively small incremental steps from the smallest towns to the largest cities. In other cases the movement may be directly from the countryside to the largest urban agglomerations. We investigate pattern for China, tracing not only "upward" movement, but also how much reverse movement down the urban hierarchy is taking place at the same time. Urbanization analysis has been incomplete, if not outrightly deficient, in presuming in inexorable movement up the hierarchy and being rather unclear (often because of data limitation) about the scale of the movement, the size of the steps, and the amount of reverse migration.

More is of interest than a simple documentation of moves. Since people of different

skill levels move at different rates and to different destinations, the process of population redistribution and urbanization represents a substantial shift in national human capital. Our analysis gives an improved picture of what is happening. It helps, we hope, to set the stage for further thinking about the relationship between geographic population mobility and economic development. Our results may encourage some thinking for policy, as one considers the environmental consequences of the shift in persons, industry and consumption. There is initial evidence that economic development has widened the gap in average well-being level across China's cities [White, Wu, and Chen, 2008], and so our more detailed analysis may help inform further thinking about socio-spatial policy as this dramatic shift in human capital proceeds.

We use the micro-data from the China 2000 Census and a multinomial statistical model to study the main characteristics of non-migrants, temporary and permanent migrants, and their origin and destination in major metropolitan areas, other cities, small towns and rural areas. From our statistical results, we simulate the major migration patterns by human capital of the migrants across areas by urbanization categories.

Data and Methods

We use the 0.95% sample dataset of the long form of the China 2000 Census for the analysis. In the China 2000 Census, a random sample of 10% of the total households was selected to fill out the long form, while the other 90% of the households answered the questions in the short form. In addition to the standard demographic questions asked of short form respondents, the selected 10% long form households were asked to provide more detailed information, including information on migration.

In the 2000 Census, migrants are taken to be those who changed their place of residence across the administrative boundary of townships (for rural population) or town/jiedao (for urban population) in the five years prior to the census and did not consecutively leave the present places for more than half year. According to household registration (*hukou*) and migration status, we divide the rural and urban population into three groups: non-migrant, permanent migrant, and temporary migrant. Temporary migrants are those who have left their place of household registration for more than half a year at the time of interview (Nov. 1, 2000); by contrast, a permanent migrant is a migrant who has moved to a new place and officially changed household registration within the past five years; non-migrants refers to those who have stayed at their place of household registration for at least five years.

In our analysis, persons are also classified according to their residence in the areas along urban hierarchy. The administrative organization of the Chinese urban system is rather complex, but it can generally be divided into cities, town and rural areas. In particular, cities may have administrative status of municipality at provincial level, city at prefecture level, and city at county level. Places of different administrative status in urban hierarchy are given different levels of authority and access to political and economic resources. The higher the level, the greater are its autonomy. Usually, larger

urban areas have higher administrative status, greater political power and access to resources. Here, we define four categories of areas in the urban hierarchy: (1) municipality, including Beijing, Tianjin and Shanghai (BTS hereafter¹), (2) other cities, (3) towns and (4) rural areas.

Hypotheses:

Based on the understanding of China's migration and its impact on urbanization described in the previous sections, we advance the following hypotheses:

1. The migration pattern will involve a net flow of migrants upward along the urban hierarchy;
2. The higher the place in the urban hierarchy, the higher the proportion of migrants (particularly permanent migrants);
3. Moves will be predominantly in steps across single levels, meaning that rural migrants more likely move first to small towns, before entering central city of the region, and finally to the major municipality;
4. Migrants will be strongly differentiated on the basis of personal and human capital characteristics; specifically we expect to find that migrants (compared to stayers) are younger, males, non-married singles, more educated, and non-agricultural *hukou* holders, particularly among permanent migrants;
5. Human capital (HC) will be disproportionately directed up the urban hierarchy. That is, in micro-models predicting move, education (and selected other HC-related traits) will predict greater likelihood of destination "up" rather than stay or movement "down."

We test these hypotheses, using descriptive methods and multinomial regression models. Considering the fact that in addition to the migration flow along urban hierarchy, there is another general trend of population movement across regions – migrants moving from the less developed West and Central regions into the more developed East coastal areas; thus, we also identified persons according to their region of origins as given by the National Statistical Bureau (2003)². To analyze the feature of migrants, we differentiate between traits that are assuredly predetermined, and those that may have changed over the migration interval, a common issue in working with census data to study migration. The first group of features such as age, gender and *hukou* status is not affected by migration itself. The second group of features such as occupation, education, marital status might

¹ Chongqing as one of the four provincial level municipalities in China is not include in the "municipality" because (1) it was only established as a municipality in July 1997; (2) it includes 21 counties and 19 districts with more than 60% of population were rural residents.

² According to National Statistical Bureau (http://www.stats.gov.cn/tjzs/t20030812_97125.htm), the mainland China can be divided into three main sub-economic regions based on their geographic locations, natural conditions, and economic development levels – east, central and west. The east includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. The central region includes Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. The west includes Sichuan, Chongqing, Guizhou, Yunnan, Xizan, Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang, Guangxi and Neimenggu.

change due to migration. In the Census, only current status of occupation, marriage and education was recorded. However, we are able to derive for migrants the marital statuses before migration based on the information on event and timing of marriage and remarriage. We exclude from the analysis those younger than 15 years old, enrolled in school and reporting education as main migration reason, so that we could reasonably assume that the rest of migrants did not change their education in the process of migration. However, we could not derive information on occupation of migrants before move, and therefore we omit occupation from the regression analysis.

Results

A. Migratory flows and the Urban Hierarchy

A.1 Basic flows in the Hierarchy

China's population redistribution in the period of 1995-2000 has been decidedly "up the urban hierarchy." Of all the migrants who moved across city district and township administrative boundaries, 7.2% made the city districts of 3 large provincial level municipalities of Beijing, Tianjin, and Shanghai (BTS) as their destination; 53% moved to other cities, 17.5% to small towns, and 22% to the rural areas. Very few migrants leave BTS. Some 90% of the migrants stay within those entities or move among them, and of the 10 percent who do leave the majority move to towns or other cities. Some 84% of migrants who depart from the remaining cities also cycle among the members of the same cities. That is they are moving from one large city (other than BTS) to another. This illustrates considerable robustness in the urban migratory circulation system in China. Table 1 also indicates the pivotal position occupied by towns. Of those migrants who depart their original town in 1995, more than half moved up the urban hierarchy (BTS or other cities), while 23% circulated among other towns. About one third of rural out-migrants moved to another rural location in the 1995-2000 period, but the remainder moved "up" the urban hierarchy. There is no clear evidence that migration contributed to a more even distribution of city size. Considering the general trend of eastward migration across different regions in the recent two decades, we also examine the pattern of population redistribution across human settlement by the regions of east, central and west China. The migrating pattern of moving up the urban hierarchy is consistent among all three regions, while small differences exist (see Appendix 1).

The 2000 Census shows that 33.7% of resident BTS population and 26.2% of population in other cities were migrants, while the proportion of migrants was only 13.8% for towns and 3.7% for the rural areas. Table 2 also indicates that significant proportion of the non-migrants in BTS (18%) and other cities (15%) are floating population who had moved and lived in the recent places for more than five years without officially changing their registration of residence. Consequently, BTS and other cities gain population through population migration, while rural areas and towns lose population due to net out-migration.

Table 1. Destination Distribution of Migrants 1995-2000 by Urbanization Level

		Destination Distribution of Outmigrants				
		municipality (BTS)	other cities	town	rural	N (000s)
original location category	municipality (BTS)	89.8%	3.7%	3.3%	3.2%	5250
	other cities	2.0%	84.1%	6.4%	7.4%	33110
	Town	3.7%	47.7%	23.0%	25.6%	49355
	Rural	4.6%	39.3%	22.3%	33.9%	35652
	Total	7.2%	53.2%	17.5%	22.2%	123367

Table 2. Population composition of areas by urbanization levels

	municipality (BTS)	other cities	town	rural
Local permanent resident	53.9	62.7	79.1	94.1
permanent migrant within province	9.7	8.2	3.6	1.3
permanent migrant outside province	1.5	0.9	0.3	0.2
floating population of non-migrants	11.9	10.9	6.9	2.2
temporary migrants from the same province	11.2	12.6	6.2	1.2
temporary migrants from other provinces	11.7	4.7	3.9	1.0
Total	100.0	100.0	100.0	100.0

A.2 Step migration

The classic pattern of migration in developing nations involves a sequence of moves with steps across single levels of urban hierarchy. One presumption is that such mobility allows gradual adjustment and moderates the financial and psychic costs of migration between different types of places. The sequential process of migration termed as ‘step migration’ has not been quantitatively tested in China due to data limitation.

In addition to the information on origin and destination of recent migration, the 2000 Census also asked migrants on the type of residence in their *hukou* registration which can be used as a proxy of places prior to the origin. With this piece of information, we can track two steps of movements of the migrants – the recent migration and the migration before coming to the place of origin. However, from the type of residence in the *hukou* registration, we cannot make distinction of residence between town and other cities. Therefore, only three urban categories are identified for the locations prior to the origins (Table 3). Our analysis reveals that, in the previous step of migration (the migration before the most recent movement), of the migrants from rural area, more than 50% moved into towns, while only 4% moved into other cities and less than 0.4% to BTS. In the recent movement, those who moved into towns from rural areas in the previous migration, 42% moved into other cities and 3.5% to BTS. Therefore, we do observe that migrants disproportionately moved one level up along the urban hierarchy in each single step of movement. However, the migrants, who arrived in the other cities from rural or towns in the previous migration, do not have a higher probability moving into BTS in the recent movement. This differs from the experiences in some other developing nations. One

important reason for this phenomenon might be embedded in China's special urbanization policy, which is stipulated to control population growth in the large cities, while encouraging development of small towns and moderately development of middle-size cities.

Similarly, of those migrants from towns or other cities, 12% moved to towns, 69% moved to other cities and 11% to BTS in the recent migration, compared to 28% had moved to towns, 51% to other cities and 8% to BTS in the previous migration. Therefore, migrants from an urban settlement also progressively moved into larger urban settlements in the past two steps of migration.

Of those who moved from rural areas into towns in the previous migration, in their recent movement 42% moved into other cities and about 5% to BTS, while 32% moved back to rural areas. Of those who initially moved from rural areas into other cities, in the recent migration.

Table 3 Migrants by destination, origin and residence before the recent migration

		original place	destination 2000			
			BTS	other cities	town	rural
location prior to the original place	BTS	BTS	9	63	12	15
		other cities	0	15	4	0
		town	0	11	5	1
		rural	0	1	0	1
		Total	9	90	21	17
	Urban	BTS	4548	113	139	65
		other cities	614	25905	1797	1559
		town	664	9778	4016	2113
		rural	169	3319	1846	1103
		Total	5995	39115	7798	4840
	Rural	BTS	133	13	22	82
		other cities	39	1693	255	764
		town	1133	13571	7261	10355
		rural	1453	10582	6040	10847
		Total	2758	25859	13578	22048

Linking the migration flow in those two steps, we also found out that the probability of moving up the urban hierarchy by migrants who initially moved into towns from the rural is 45%, compared to the 32% of probability of moving down to the rural areas. The odds ratio of upward vs. downward migration is 1.4. Similarly, the probability of moving to cities and BTS by migrants who initially moved into town from an urban setting is 63%, while the probability of the same group of people moving down to the rural areas is only 16%. It suggests an odds ratio of 4.9. Therefore, migrants originated from towns in the

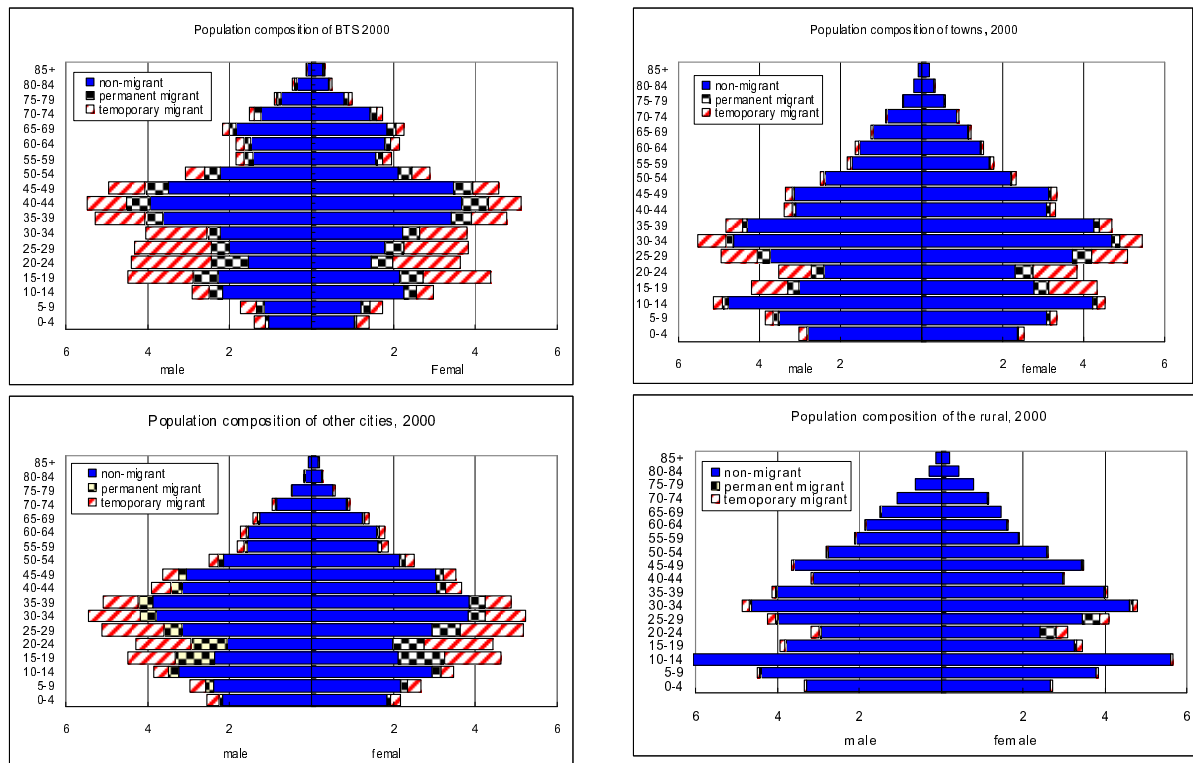
recent movement, disproportionately moved up the urban hierarchy, not matter they came to the towns from either an urban or rural settlement. However, the odds ratio of moving up to BTS vs. down to rural and towns in the recent migration for those who came to other cities from either rural or urban settlements in the previous migration is only 0.04 and 0.18 respectively. This is partially due to the above-mentioned fact that China implemented a policy of strict control of large cities. In the 2000 Census, population of BTS only accounted for 2.2% of national total. As matter of fact, population migration still significantly contributed to the population growth in the large cities, like BTS.

A.3. Migration and Population Composition in the Settlement System

Migration not only caused changes in the population size among regions through redistributing in the aggregate, it also considerably altered population age and gender composition of the areas by urbanization levels due to migration selectivity. For example, permanent and temporary migrants greatly contributed to the stock of labor force population in the urban areas, particularly in BTS and other cities (Figure 1). More strikingly, the majority of population aged 15-29 in BTS and population aged 15-24 in other cities fall into the categories of migrants. Those migrants were mostly migrating workers, (some were college students, ranging from 1% of temporary migrants aged 25-29 in BTS to 94% of permanent migrants aged 15-19 in other cities). To a considerable extent, migrating workers largely contributed to sustaining rapid economic growth in cities and towns of the east coastal areas. This is particularly true for the large cities, such as Shanghai and Beijing which has been experiencing rapid population aging, due to rapid fertility caused by socioeconomic development and more strict family planning policy. Had no large inflow of working age population, population aging would have been much faster. In more recent years, shortage of workers has been reported along China's coastal regions which caused a surprise and might serve to change the mentality that there would be an unlimited cheap labor supply in China.

A closer comparison of the age profile of migrants across different locations shows that as those in other countries or regions, migrants in China are highly concentrated in age group of 15-34 across all migrating destinations (figure 2). The concentration of migrants in small age groups is the most significant in the rural areas: those aged 20-29 accounted for more than half of its total migrants. Further analysis indicates that this might be because large number of migrants to the rural areas was young women who were newly married and moved to their husbands. 30% of total migration who had the rural as destination listed marriage as their reason for migration. While the age frequency distributions of migrants in towns and other cities are very similar and rather close to that of national total, the age profile of migrants to BTS were more widely distributed across all age groups. This wider range of age distribution is likely due to the greater seniority (and hence age) of migrant officials, managers, and professionals, who compose a large portion of the flow.

Figure 1 Population pyramids by urbanization levels



In addition to the selectivity of age, there are also important gender differences among migrants by age and destinations (Figure 3). The sex ratio is low among migrants aged 15-29 in all places except the BTS – the lower the urban hierarchy, the lower the sex ratio. It reflects the fact that among majority of the newly married couples, it is the brides rather than the brooms who moved to join their partners after marriage. This patterns of marriage migration prevails particularly in the rural areas, where the sex ratio of migrants aged 15-29 was below 50 (females per hundred males). Among the elderly migrants, there are more females than males which coincides with the sex ratio of total population of later stage of life. However, the sex ratio is larger than 100 among children and middle aged population. Especially, migrants of middle age groups in the rural areas are predominantly men, indicating the traditional labor division in an agrarian society.

Figure 2. Age profile of migrants by location

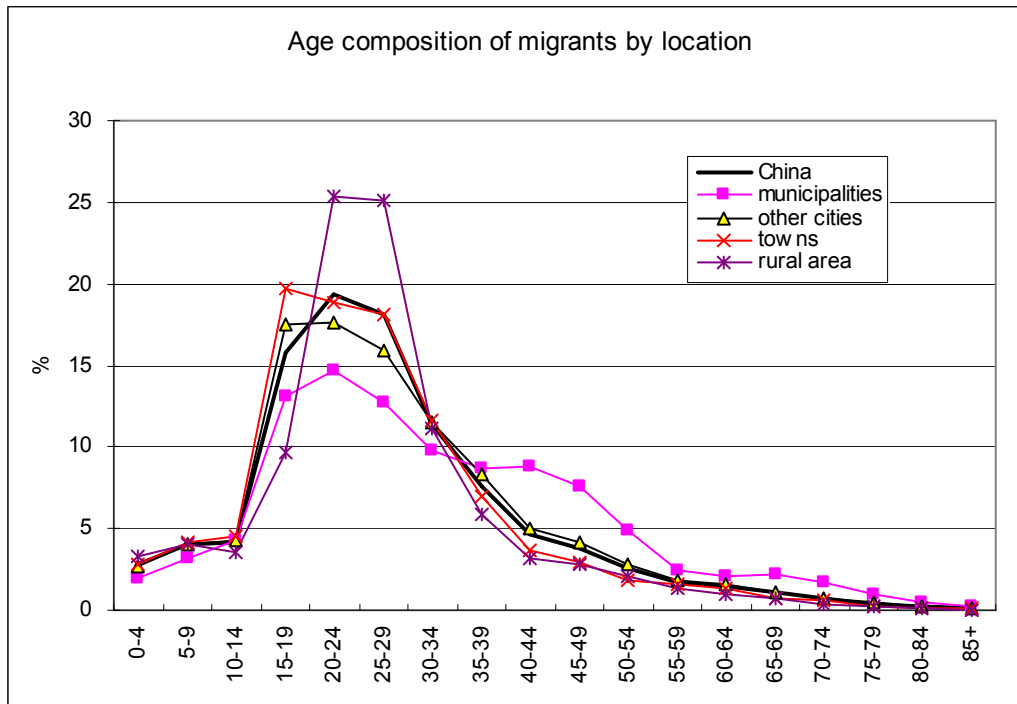


Figure 3. Sex ratio of migrants by age and location

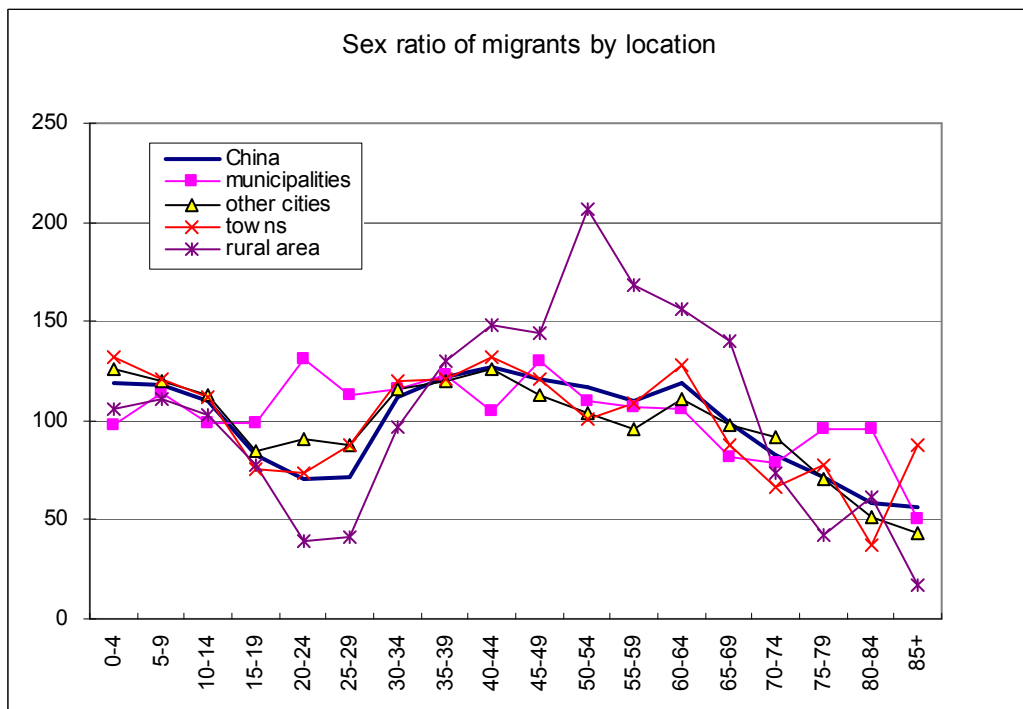
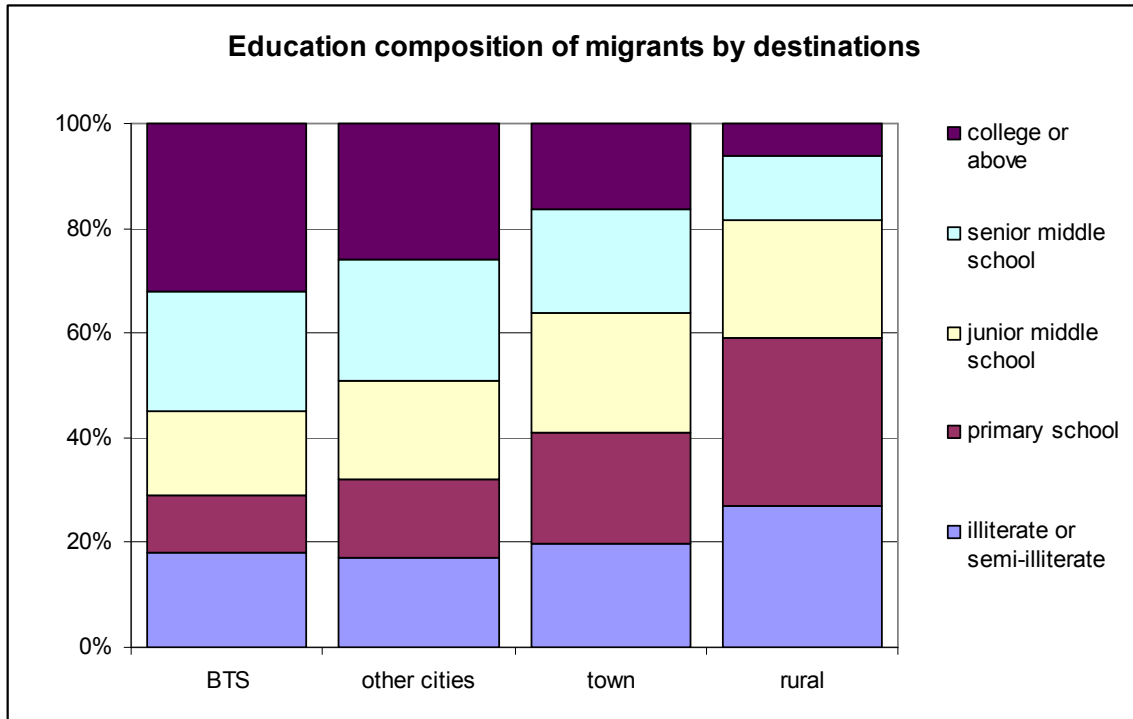


Figure 4. Education level of migrants by destination



Moreover, the composition of educational attainment of the migrants also varies substantially across migration destination, with higher educated people disproportionately moving up along the urban hierarchy. While the proportion of migrants moving into the rural, town, other cities and BTS who had junior middle or lower education are 82%, 64%, 52% and 45% respectively, the corresponding figures of those with senior middle or higher education are 28%, 36%, 48% and 55%.

The different profiles of migrants by age, gender, and education by destinations along the urban hierarchy may have considerably altered the population compositions of human settlement of various sizes in China. More profoundly, migration selectivity may have caused and would continue to enlarge the gaps of human capital across areas along urban hierarchy.

B. Multivariate Prediction of Migration Status and Destination

While the descriptive analysis provides intuitive evidence that people with various characteristics chose their destination of migration differently, it needs a more comprehensive analysis of selectivity. As some effects may enhance each other, while others may cancel out each other. For example, the age composition of migrants may generate a net effect on educational composition as younger generations are usually more educated than the older ones. Therefore, it would be specifically analyze the impacts of education on migration after controlling for the effect of age and other important variables. We adopt multinomial logit regression analysis method to further understand who the migrants are and where migrants of different types choose where to

move.

B.1. Prediction of Migration Status (permanent; temporary; none)

We first compare permanent and temporary migrants with non-migrants by age, sex, education attainment, occupation and urbanity of original place. For our research purpose, children (aged below 15) and those who are studying in the school are excluded from the analysis given their passive role in migration and uncertain and less important impact on labor market.

It evidently shows that compared with non-migrants, both permanent and temporary migrants are relatively young (not linear), more likely to be female and unmarried (never married, divorced, or widowed), relatively more educated, holding non-agricultural *hukou*, and mostly originating from rural areas than from towns or cities. The effects of gender, marital status and *hukou* status are more significant for permanent migrants, while the effect of education is slightly more significant for temporary migrants. It also shows that temporary migrants are more likely from the west and central regions, permanent migrants are more likely from the west and east regions. This is somewhat expected as people from the less developed west and central regions moved to the more developed east coastal areas, especially as temporary migrants. That single people more likely move than the married one is also within our expectation. The fact that those from the rural but with non-agricultural *hukou* are more likely to move than the urban residents and agricultural *hukou* holders seems to be contradictory. However, careful analyses would approve that many rural residents hold non-agricultural *hukou*, and non-agricultural *hukou* status would be helpful for people to move.

It is interesting to indicate that though regression coefficients point to positive relation between age and propensity for being a migrant, that the variables age and age-squared together produce inverted-U-shaped curve postulates substantially different turning points of age in relations to being temporary vs. permanent migrants. That the turning points of 16.5 years old of being temporary migrants shows that in general younger people are more likely moving without changing residential registration, while the probability of being permanent migrants increases with age up to about 43 years old. It may be due to the fact that old people are more skilled, and have been more integrated into the central-planned system than the younger ones, and therefore moved as permanent than temporary migrants. Another important finding is that Chinese women were more likely to move in the recent decades. The reasons would include that Chinese women as above-mentioned usually move to the places of their husband after marriage, that migration in China has reached the stage that family members (more women) join the first out-migrants (usually men), and that the factories engaged into assembling and processing industries recruit large number of female young workers who are usually underpaid and more easily controlled than the male workers. More significantly, our research indicates that educational attainment is important not only to be permanent migrants, but also to be temporary migrants; the more educated the more chances to move.

Table 4 Multinomial logit regression of population by migration status

	permanent migrants	temporary migrants
age	0.129 ***	0.0136 ***
Age-squared	-0.0015 ***	-0.0004 ***
gender (female=0)		
male	-0.8763 ***	-0.2283 ***
urbanity of origin (rural=0)		
town	-0.9932 ***	-0.859 ***
city	-0.491 ***	-0.3401 ***
education (primary=0)		
Illiterate	-0.2337 ***	-0.1253 ***
junior middle school	0.2931 ***	0.5301 ***
senior middle school	0.5233 ***	0.8229 ***
college or above	1.1858 ***	1.1826 ***
hukou status (agrribultural hukou=0)		
Nonagricultural hukou	1.8563 ***	0.5774 ***
marital status before move (married=0)		
never married	2.2274 ***	1.1678 ***
divorced or widowed	0.1772 ***	0.1229 ***
region of origin (east=0)		
central	-0.1607 ***	0.0561 ***
West	0.0977 ***	0.1631 ***
Intercept	-6.7124 ***	-2.9867 ***

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is non-migrants. ***p < 0.001, **p < 0.01, *p < 0.05.

B.2. Prediction of Destination (BTS, Other City; Town; Rural)

The purpose of our research is not only to study the general characteristics of migrants, but also to reveal how migration contributed to the changes in population composition across the areas of urban hierarchy. Hence, in this section we analyze the individual traits of migrants by origin and destination from/to the BTS, other cities, towns and the rural areas.

a. Prediction by origin place

Migrants from the BTS moving within the BTS are more likely married, female, with non-agricultural *hukou* status, and more educated; those moving to the rural areas are the low-educated and agricultural *hukou* holders (Table 5a). Migrants from other cities within urban areas are female and more educated, the higher the urban hierarchy, the bigger impact of education and gender; those moving town to the rural areas are more

likely agricultural *hukou* holders, and from west areas (table 5b). In comparison with migrants from BTS and other cities, migrants from the towns and rural areas more likely move urban hierarchy to the cities when they are male (Table 5c-d). In other words, male migrants have higher propensity than their female counterparts of moving in longer distance to cross the boundaries of areas along urban hierarchy, since female migrants from BTS and other cities less likely move down to the rural while female migrants from the town and rural areas less likely move up to the cities. Moreover, age plays a significant role for out-migrants from the towns and rural areas in moving up the urban hierarchy – the probability of moving to the urban areas vs. rural areas decreases until reaching 43 years old for town out-migrants and 45-53 years for rural out-migrants. Non-agricultural *hukou* helps out-migrants from the towns and rural areas moving into urban areas, except rural migrants moving into the BTS since BTS has stricter control over *hukou* status defiant again any non-local *hukou* registration. Moreover, our analysis consistently reveals that education is very significant in determining whether the migrants moving up to the BTS, other cities or down to the rural areas; the higher the urban hierarchy, the more substantial the educational impact is. Table 5c-d also shows that those never married migrants from the rural and town less likely move out from the rural and towns than the married ones. This is somehow against ones' intuitive impression, as people observed large low of migrants are young and single individual moving from hometown in searching job opportunities in the urban areas. We may explain this phenomenon from two angles. First, migration to the urban or rural is selected by more the traits of education and age than the variable of marital status – as the never married are more likely the younger and more educated. After controlling for other variables such as age and educational attainment, the married rural and town out-migrants actually are more inclined to move into the cities. Second, large proportion of migrants moved for the reasons of marriage, and family reunion. The single floating population from the rural areas or small towns may move back and marry in their hometowns, while the ever left-behind wives may join their husbands who migrated in the urban areas some times before.

Table 5a Multinomial logistic regression of migrants from the BTS by destinations

	BTS	other city	Town
age	0.0182	-0.1067 *	-0.0511
age-squared	-0.0001	0.0009	0.0004
gender (female=0)			
male	-0.6529 * *	-0.1373	-0.2102
education (primary=0)			
illiterate	0.6117	-0.1394	0.458
junior middle school	1.4787 * * *	0.6995	1.4851 * *
senior middle school	2.2841 * * *	1.5441 * *	1.3235 *
college	2.467 * * *	2.8916 * * *	1.4714 * *
hukou status (agricultural hukou=0)			
non-agricultural hukou	3.0452 * * *	1.8112 * * *	2.1188 * * *
marital status before move (married=0)			
single	-0.9382 * *	-0.6497	-0.6862
divorced or widowed	0.364	1.3399 *	0.3422
Intercept	-0.4912	0.2223	-0.8833

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

Table 5b Multinomial logistic regression of migrants from other city by destinations

	BTS	other city	Town
age	0.0309	0.0518 * * *	-0.0379 *
age-squared	0.0001	-0.0004 * *	0.0003
gender (female=0)			
male	-0.7455 * * *	-0.5572 * * *	-0.2026 * *
education (primary=0)			
illiterate	0.3162	0.6069 * *	0.4985
junior middle school	1.9303 * * *	0.8212 * * *	0.4316 * *
senior middle school	2.0945 * * *	1.1255 * * *	0.7081 * * *
college	3.2626 * * *	1.6264 * * *	1.1613 * * *
hukou status (agricultural hukou=0)			
non-agricultural hukou	1.0378 * * *	1.5427 * * *	0.9908 * * *
marital status before move (married=0)			
single	0.1585	-0.6834 * * *	-0.1615
divorced or widowed	-0.4271	0.3534 *	-0.4257
region of origin (east=0)			
central	-0.1533	-0.6089 * * *	-0.0965
west	-0.5251 * * *	-0.7824 * * *	-0.1099
Intercept	-5.3058 * * *	-0.2354	-0.5107

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

Table 5c Multinomial logistic regression of migrants from town by destinations

	BTS	other city	Town
age	-0.0882 * * *	-0.0828 * * *	-0.085 * * *
age-squared	0.001 * * *	0.001 * * *	0.001 * * *
gender (female=0)			
male	0.7357 * * *	0.3914 * * *	0.2963 * * *
education (primary=0)			
illiterate	0.2507	0.0951	0.0101
junior middle school	0.5992 * * *	0.49 * * *	0.4203 * * *
senior middle school	0.6733 * * *	0.7104 * * *	0.6596 * * *
college	0.8335 * * *	0.9165 * * *	0.9102 * * *
hukou status (agricultural hukou=0)			
non-agricultural hukou	0.5097 * * *	0.6086 * * *	0.7169 * * *
marital status before move (married=0)			
single	-1.0703 * * *	-0.8087 * * *	-0.8179 * * *
divorced or widowed	-0.8053 * *	-0.3435 * *	-0.2883 *
region of origin (east=0)			
central	-0.6711 * * *	-0.3261 * * *	-0.0341
west	-1.6902 * * *	-0.5204 * * *	-0.0506
Intercept	-0.2876	1.8739 * * *	1.104 * * *

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

Table 5d Multinomial logistic regression of migrants from the rural by destinations

	BTS	other city	Town
age	-0.1195 * * *	-0.1217 * * *	-0.085 * * *
age-squared	0.0011 * * *	0.0014 * * *	0.001 * * *
gender (female=0)			
male	0.9371 * * *	0.4958 * * *	0.2963 * * *
education (primary=0)			
illiterate	0.5869 * * *	-0.0094	0.0101
junior middle school	0.6094 * * *	0.5326 * * *	0.4203 * * *
senior middle school	0.7219 * * *	0.8113 * * *	0.6596 * * *
college	0.6345 * *	0.5661 * * *	0.9102 * * *
hukou status (agricultural hukou=0)			
non-agricultural hukou	-0.4242 * *	0.323 * * *	0.7169 * * *
marital status before move (married=0)			
single	-1.1881 * * *	-0.9456 * * *	-0.8179 * * *
divorced or widowed	-0.4548	-0.2552 *	-0.2883
region of origin (east=0)			
central	-0.8804 * * *	-0.1827 * * *	-0.0341 **
west	-2.5176 * * *	-0.5927 * * *	-0.0506 **
Intercept	1.1177 * *	2.4285 * * *	1.104 * * *

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

b. Prediction by migration status

In the previous section, we studied the features of migrants according to their origins and destinations in order to understand how migration across areas of urbanity contributed to the changes of population composition of those areas along urban hierarchy. As it is well-known that migration in China is still under-control by the government, mainly through *hukou* system, the on-going reform of the *hukou* system may have exerted effects on the migration of people with various characteristics in areas of urban hierarchy and will generate larger impact on the patterns of future population movement. To a great extent, the permanent migrants are under the central-planned system while temporary migrants are largely directed by the market-oriented economic system. Moreover, the reform of household registration system started from towns and small cities, while most of the large cities, particularly the BTS, are still hesitating and lagging behind in this movement. In this section, we analyze the how migrants as permanent and temporary migrants with various features moved across areas of urban hierarchy, and hope to capture the dynamics of population movement and its possible trend in the future.

Among all the migrants, the males, non-agricultural *hukou* holders, more educated, married, those from the east have larger chances moving into the urban areas than to the rural areas; the younger ones also more likely moved into the urban than the rural until reach later stage of age (44 for BTS, 53 for other city, and 56 for the towns). Table 6a also indicates that migrants from the areas of same categories of urban hierarchy tend to stay within those entities vs. down to the rural areas, particularly for migrants from BTS and other cities, while more migrants from urban areas of different entities likely move down to the rural areas. Though it provide information on the migration pattern of overall migrants, analysis by permanent and temporary migration status reveal a more sophisticated picture of population movement in China.

Table 6a Multinomial logistic regression of all migrants by destinations

	BTS	other city	town
age	-0.079 ***	-0.0771 ***	-0.0869 ***
age-squared	0.0009 ***	0.0009 ***	0.001 ***
gender (female=0)			
male	0.4662 ***	0.2557 ***	0.2571 ***
origin (rural=0)			
BTS	3.484 ***	-1.3022 ***	-0.495 ***
other city	-0.7356 ***	1.32 ***	-0.6101 ***
town	-0.4154 ***	0.2187 ***	0.1629 ***
education (primary=0)			
illiterate	0.2752 **	0.0024	-0.0269
junior middle school	0.774 ***	0.5663 ***	0.4615 ***
senior middle school	1.0134 ***	0.7923 ***	0.6939 ***
college	1.4767 ***	1.1095 ***	1.0392 ***
hukou status (agricultural hukou=0)			
non-agricultural hukou	0.5539 ***	0.7383 ***	0.873 ***
marital status before move (married=0)			
never married	-1.0387 ***	-0.8899 ***	-0.7533 ***
divorced or widowed	-0.4607 ***	-0.115	-0.2337 **
region of origin (east=0)			
central	-0.7172 ***	-0.2789 ***	0.0516 *
west	-1.8745 ***	-0.5735 ***	-0.0778 **
Intercept	-0.1106	1.5444 ***	0.8942 ***

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

Comparison of the regression analysis results between migrants with and without local residences (Table 6b-c) indicates some very different patterns of individual traits affecting permanent and temporary migrants in choosing migration destinations. While the younger temporary migrants are inclined to moving into urban areas in general, the older ones had more chances moving into the BTS and other cities as permanent residents. This reflects the fact that senior citizens are more embedded into the old central planned system than the younger generation and granted with more chances of moving as permanent residents. Moreover, non-agricultural *hukou* status is important for permanent migrants moving into the BTS, other cities and towns than to the rural areas; and the higher the urban hierarchy, the more important the *hukou* status is. However, non-agricultural *hukou* is not significant for temporary migrants moving into the urban areas. To some extent, the movement among the temporary migrants indicates the pattern of population movement in a market-oriented economic system. While age and *hukou* status indicating different trends between permanent and temporary migrants, some other migrating patterns persist among both the two types of migrants.

Both permanent and temporary migrants from the east have much significantly higher opportunities moving into the BTS, other cities and towns than to the rural areas; the higher the urban hierarchy, the more significant the effect is. This is mainly due to the facts that the larger urban settlements are mostly located in the east regions, and that

the decreasing proportion of migrants moved as distance increasing. That migrants moved largely within the entities of urban hierarchy is true for both temporary migrants and permanent migrants. However, the effect is stronger among the permanent migrants than the temporary migrants, which indicates the increasing population movement across administrative boundaries in the market economic system. A more consistent pattern of individual traits in affecting migration across areas of urban hierarchy among both permanent and temporary migrants is that education is important for people moving into urban areas vs. rural areas; and the higher the urban hierarchy, and the more significant the impact is. As the existing research shows that, Chinese people were largely locked from movement under the household registration system in the old central-planned system; one of the most important channels for citizens (especially rural residents) to change *hukou* status was through higher education. Since the 1970s, increasing number of people changed their household registration by being recruited into colleges and assigned jobs after graduation. Others who are more educated and work as professional personnel, officials or office staff will usually be granted a permanent residence as they move into large cities or other urban areas through job relocations (this can be seen in more detail in the discussion of migration reasons in the appendix 2). Therefore, one would not be surprised to see the tendency of more educated individuals moving up the urban hierarchy under the central planned economic system. What is more striking is that the fact of streaming the more skilled personnel upward along urban hierarchy to larger urban settlement is also phenomenal among the temporary migrants who are supposed to move less likely being affected by the state-plan economic system. The impact on population composition by labor skill is reflected in education attainment here. In fact, we also consider the variable of occupation, but do not include the results here since information on occupation is only available for the time point of the census, and migrants had very likely changed their occupations. The analysis including current occupations shows that the pattern of moving up urban hierarchy by the more educated migrants persists, while the effect of occupation is more diverse.

Table 6b Multinomial logistic regression of permanent migrants by destinations

	BTS	other city	town
age	0.1377 ***	0.0764 ***	0.011
age-squared	-0.0009 **	-0.0006 ***	0
gender (female=0)			
male	-0.4726 ***	-0.2529 ***	0.013
origin (rural=0)			
BTS	3.8919 ***	-1.3441 ***	-1.3947 ***
other city	-0.8851 ***	1.7095 ***	-0.5326 ***
town	-0.3544 *	0.4148 ***	0.2432 ***
education (primary=0)			
illiterate	0.3269	0.0856	-0.008
junior middle school	1.1927 ***	0.7159 ***	0.3804 ***
senior middle school	1.5094 ***	0.68 ***	0.5616 ***
college	1.9309 ***	0.8846 ***	0.7274 ***
hukou status (agricultural hukou=0)			
non-agricultural hukou	4.6609 ***	3.2012 ***	2.6425 ***
marital status before move (married=0)			
never married	-0.3922 *	-0.5709 ***	-0.5306 ***
divorced or widowed	0.2561	0.3575 *	0.2209
region of origin (east=0)			
central	-2.0575 ***	-0.6182 ***	-0.3003 ***
west	-2.4766 ***	-1.0236 ***	-0.3006 ***
Intercept	-9.1735 ***	-3.7562 ***	-2.1682 ***

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

Table 6c Multinomial logistic regression of temporary migrants by destinations

	BTS	other city	town
age	-0.0184	-0.0201 ***	-0.0263 ***
age-squared	0.0002 *	0.0003 ***	0.0004 ***
gender (female=0)			
male	0.1687 ***	-0.0794 ***	-0.1154 ***
origin (rural=0)			
BTS	3.9013 ***	-0.5797 **	0.6242 ***
other city	-0.3868 ***	1.4046 ***	-0.3185 ***
town	-0.4364 ***	0.1481 ***	0.1256 ***
education (primary=0)			
illiterate	0.3125 **	0.0043	-0.0538
junior middle school	0.6557 ***	0.5013 ***	0.4434 ***
senior middle school	0.7324 ***	0.6853 ***	0.5415 ***
college	1.1144 ***	1.0219 ***	0.8687 ***
hukou status (agricultural hukou=0)			
non-agricultural hukou	-0.0132	0.0148	0.0076
marital status before move (married=0)			
never married	-0.4599 ***	-0.3217 ***	-0.2263 ***
divorced or widowed	-0.5225 **	-0.0732	-0.2228 *
region of origin (east=0)			
central	-0.7346 ***	-0.3706 ***	0.0062
west	-1.9191 ***	-0.6215 ***	-0.1493 ***
Intercept	-0.6357 **	0.9928 ***	0.1547

Notes: Children and students at time of census are excluded from the analysis; Reference category for the equation is Moving to the Rural. ***p < 0.001, **p < 0.01, *p < 0.05.

B.3. Simulation of Key Results

The discussion on results of multinomial regression analysis indicates some general patterns of population movement across the areas of urban hierarchy. However, due to the sophisticated interactions of large number of variables, it is difficult to clearly identify the net impact of each variable in determine the probability of migrants moving from one location to another. Adopting simulation method, in this section we explore the probabilities of migrants with various characteristics migrating along urban hierarchy, paying particular attention to the effect of education. Based on the statistical analysis, we simulate the major patterns of migration by a hypothetical individual with certain traits moving across areas of hierarchy in order to gain insight for the understanding the future trends of migration and their impact on urbanization processes.

We consider two typical cases. In the first case, we assume a 20 year-old never married man with agricultural *hukou*, and living in the rural area of east region. The probability for him to be a migrant goes up as his educational attainment increase; and this is true for being both a permanent migrants and temporary migrants, with much higher probability of being a temporary migrant (figure 5, based on multinomial logit regression results in Table 4). In another case, we consider a 35 year-old married woman who lives in a city of the west region. It is similar to the first case that the probability for her to be a migrant also goes up with education. However, her chance of

being temporary migrants and permanent migrants are very similar at the same education levels, 5-6 percent for the illiterate, 6-7 percent for the primary school, 8-10 percent for the junior middle school, 10-13 percent for the senior middle school, and about 16% for the college. Compare the two cases, the female individual has the probability of being temporary migrants approximately half that of the male individual, while her chance of being permanent migrants is about twice of the latter.

Figure 5a Simulating the probability of individual 1 being permanent or temporary migrants

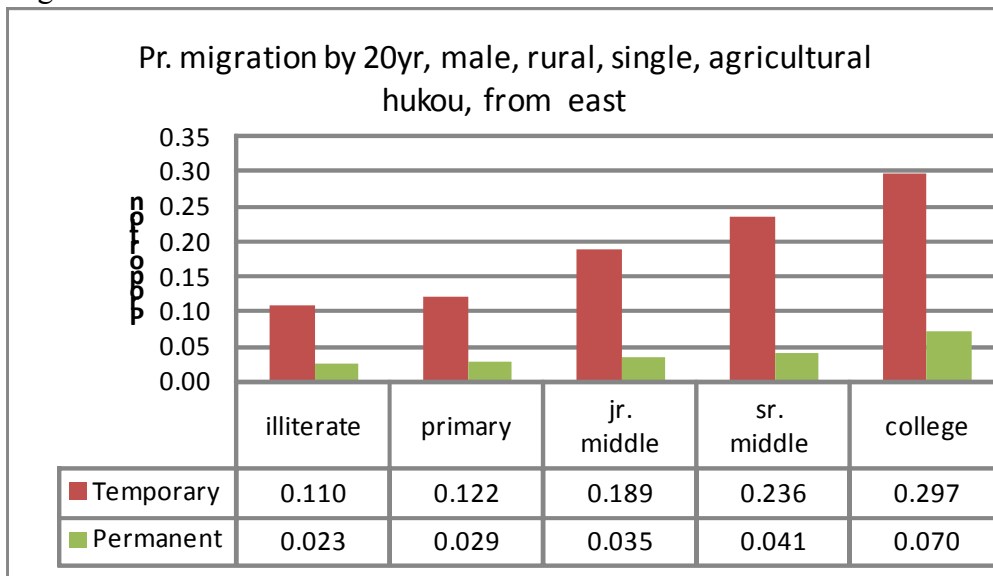
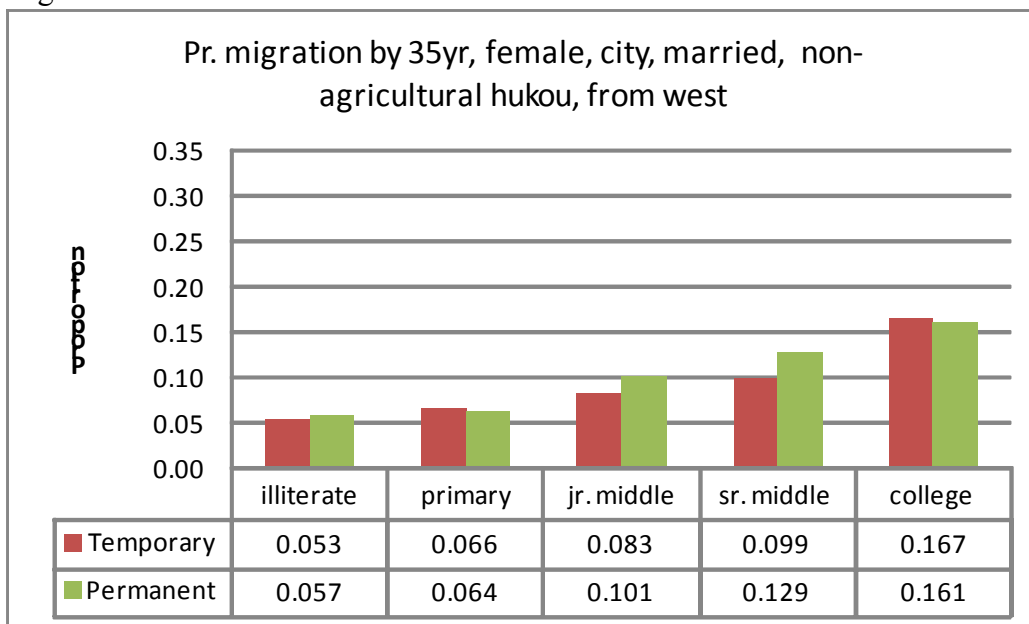


Figure 5b Simulating the probability of individual 2 being permanent or temporary migrants



We further explore the probability of these two individuals for moving across the areas

of urban hierarchy under different educational attainment, based on multinomial logit regression analysis results in Table 6a. Figure 6a shows that the 20 year-old unmarried rural migrant from the east will have 44-52% of chance moving into other city, 10-17% of chance to the BTS, 19-22% of chance to a town, and 9-24% of chance remaining in the rural. More importantly, if his educational attainment is higher the probability for him to remain in the rural areas will be lower (24% for illiterate vs. 9% for college or above), and the probability to move into urban areas will be higher. For the second case, the 35 year-old married female migrant from a city in the west will mostly move to another city district within the same entity of urban hierarchy (with a probability between 74 to 89%). The higher educational level she has, the higher probability for her to remain in city entity is. Although her chance of moving into the BTS is pretty small, she would more likely do so as her education attainment increase (from 0.5% as illiterate to 2.5% with college or above education). Reversely, she would have decreasing probability of moving into towns or rural areas as her educational level goes up (from 8% to 5% to towns, from 17% to 4% to the rural, for illiterate and college or above education respectively). It is apparent that education attainment is crucial for migrants to move out if their original place is in the lower level of urban hierarchy, and for migrants to remain within the entity if their original place is in the upper level of the hierarchy. Moreover, education level is also important for individual migrants to climb up along the urban hierarchy once they move out beyond the entity of the hierarchy.

Figure 6a Simulating the probability of individual 1 moving along urban hierarchy

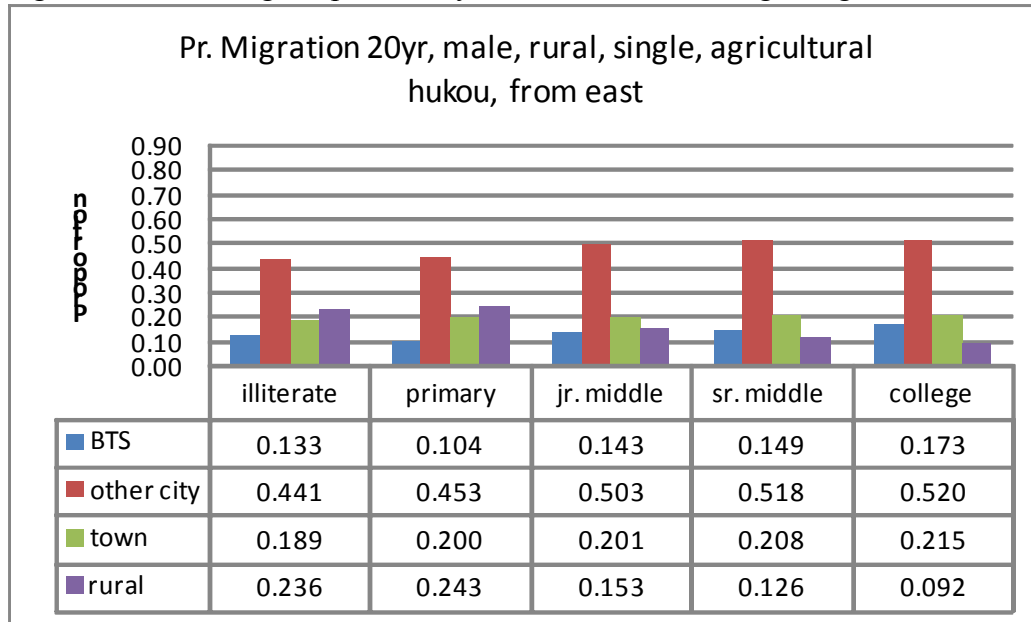
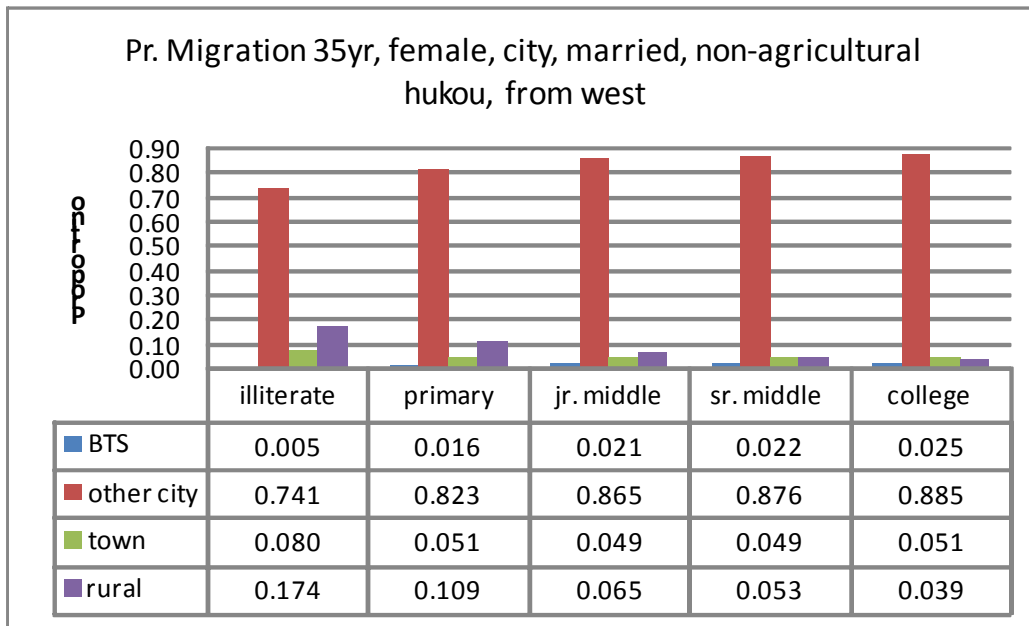


Figure 6b Simulating the probability of individual 2 moving along urban hierarchy



Discussion and conclusion

We have used microdata from the 2000 census to examine patterns internal migration in China. Our goal has been to understand the redistribution of population throughout the urban hierarchy during this period of rapid Chinese urbanization. In addition, we sought to understand the relationship between individual determinants of types of migration and the choice of destination in the hierarchy. Our results offer some confirmation for the case of contemporary China or certain patterns of movement and predictors of migration. At the same time, our results identify more detailed features of the internal migration system in China, not all of which aligns with simple conventional wisdom or prevailing assumptions. Our results also offer some insights into consequences of this net redistribution and its implications for spatial equality and regional policy.

Our major overall finding is that China's 1995-2000 population redistribution has been decidedly "up the urban hierarchy." This confirms our first hypothesis. Overall there were over 4 migratory movements up the urban hierarchy (of four levels in our classification) for every movement down.

Our second hypothesis argued that the higher the place in the urban hierarchy the larger the fraction of residents would be migrants. We found this to be true as well. About 46% of BTS residents (the three largest metropolitan area of Beijing, Tianjin, and Shanghai) were migrants in 2000. By contrast only about 6% of rural area residents and 20% of town residents were migrants.

Less clear from either theory of earlier empirical experience is the nature of the steps in movement up the hierarchy. While all expectation and evidence indicates that net movement should be upward as a population experiences economic development, the actual

sequence of events – steps across the levels – is much more open to question. This is even more the case with China, because of China’s extraordinarily rapid economic growth in 1981-2000. Moreover, China’s lower fertility during this transition has augmented the role of migration. The sheer numbers of migrants, especially given the media and policy attention to temporary migrants (the floating population) in major cities, suggested a geographic mobility regime of direct relocation from the countryside to the biggest cities. We did not find this to be the case, thus confirming our third hypothesis of a more step-wise movement. Intermediate points – towns and “other cities” – still are playing a significant role as way-stations for China’s migrants.

Our fourth hypothesis argued for the significant manifestation of differentials in personal traits in the migratory streams. In our basic model (any move versus stay) we also found an inverted U-shaped effect of age. We found that males were less likely to migrate overall, in contrast to our expectation and much prior research generalization. We did also find that those with nonagricultural *hukou* and the unmarried were more likely to migrate. As we examined in more detail the streams (differentiated by origin-destination and temporary-permanent) we found less consistency in these associations between individual traits and migration. In most of our models we find that individuals originating (residing in 1995) in the Central or West regions, we less likely to migrate (vs. those originating in the already more developed East.)

Our fifth and final hypothesis argued that human capital would be disproportionately directed up the urban hierarchy. We found this to be the case. We also found this to be the case for overall migration: educational attainment exhibits a strong gradient, with the more educated more likely to move and more likely to seek destinations higher up on the urban hierarchy. The education gradient was manifest in both temporary and permanent migration. Notably the educational gradient was strongest for those relocating to BTS and to other cities. Our simulations summarize a couple of the key dimensions that link human capital to the probability of migration and the direction to a particular destination.

Migration is producing significant changes in the urban and regional demography of China. For example, permanent and temporary migrants greatly contributed to the stock of labor force aged population in urban areas (Figure 1). This not only produces a change to the aggregation population of these places, but also a significant alteration of their population composition by age, sex, and educational (skill) level,. Our age pyramids show considerable unevenness in the age distribution for locations in the urban hierarchy. This is probably most notable in the surfeit of young working-age populations and very small shares of young children in the major (BTS) metropolitan areas. There is a corresponding overrepresentation of adolescent children in the rural areas and a somewhat higher share of older workers.

Migration streams show considerable additional selectivity by education. (In results not shown there are associations with occupation, although we can only measure occupation at the end of the migration interval with out census data.) The net redistribution – aggregate population, by core demographic traits, and by skill level – is enormous and consequential. While there is undoubtedly a beneficial synergy between China’s contemporary economic

development and the redistribution of population along these demographic and skill lines, these movements also have important implications for the future. All evidence points to parts of China's geography – rural areas, the Western and Central regions, certain cities – not only being left behind in China's economic juggernaut, but also being left with dependent and less skilled populations.

Appendix 1

Migration flow along urban hierarchy across the east, central and west regions

(the east)

		Destination Distribution of Outmigrants				
		municipality (BTS)	other cities	town	rural	N (000s)
original location category	municipality (BTS)	92.2	2.6	2.9	2.3	5110
	other cities	4.4	84.1	5.7	5.8	15372
	Town	6.0	48.5	22.7	22.8	30151
	Rural	9.9	39.5	23.2	27.4	16489
	Total	13.2	50.9	17.4	18.5	67122

(the central)

		Destination Distribution of Outmigrants				
		municipality (BTS)	other cities	town	rural	N (000s)
original location category	municipality (BTS)		43.8	7.5	48.8	80
	other cities		86.0	6.4	7.6	9968
	Town		48.3	21.9	29.8	8975
	Rural		43.1	20.9	35.9	8822
	Total		60.1	16.0	23.9	27845

(the west)

		Destination Distribution of Outmigrants				
		municipality (BTS)	other cities	town	rural	N (000s)
original location category	municipality (BTS)		43.3	31.7	25.0	60
	other cities		81.8	7.9	10.3	7770
	Town		44.8	24.9	30.3	10229
	Rural		35.6	22.0	42.5	10341
	Total		51.5	19.2	29.3	28400

Appendix 2 Analysis of reasons for move by migration flow

Migration reasons by origin and destination (%)		job related				family related				old-housing demolished	other	Total
destination	origin	labor or business	job relocation	job assignment	sum	marriage	to family	to relatives or friends	sum	old-housing demolished	other	Total
BTS	BTS	4.0	2.1	4.2	10.3	5.4	7.6	3.0	16.1	62.0	11.6	100.0
	other city	34.7	8.7	10.6	54.0	6.2	8.4	14.4	29.0	1.7	15.4	100.0
	town	67.6	2.3	1.5	71.4	4.1	7.2	4.4	15.6	8.4	4.6	100.0
	rural	78.6	0.8	1.1	80.4	3.4	6.3	3.6	13.4	2.0	4.2	100.0
other city	BTS	25.5	24.1	22.8	72.4	4.8	5.5	9.7	20.0	1.4	6.2	100.0
	other city	11.8	6.4	5.2	23.4	9.3	10.3	4.0	23.6	44.2	8.8	100.0
	town	59.8	5.1	2.8	67.7	7.8	7.8	4.3	19.9	7.2	5.2	100.0
	rural	67.6	2.5	2.1	72.1	7.3	7.5	4.6	19.5	3.7	4.8	100.0
town	BTS	20.0	8.6	6.4	35.0	1.4	4.3	4.3	10.0	40.0	15.0	100.0
	other city	22.5	14.1	25.4	62.0	8.8	7.4	5.2	21.4	6.6	10.0	100.0
	town	53.2	8.7	4.3	66.2	10.1	7.9	4.2	22.2	6.8	4.8	100.0
	rural	56.9	6.8	2.9	66.5	9.8	9.4	4.6	23.7	4.1	5.7	100.0
rural	BTS	41.6	7.8	4.9	54.2	4.2	3.5	8.5	16.2	4.9	24.7	100.0
	other city	24.3	11.6	15.9	51.7	13.5	4.8	9.4	27.7	4.0	16.6	100.0
	town	37.2	4.2	3.0	44.4	39.3	3.8	4.8	47.9	2.3	5.4	100.0
	rural	33.8	3.6	1.4	38.7	42.2	5.3	5.1	52.6	4.2	4.5	100.0