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Transformations in China's Internal Labor Migration and *Hukou* System

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Abstract
This paper examines China's changing internal labor migration patterns between 1990 and 2005 as its household registration (*hukou*) system evolves. We document a drastic increase in the size of the migrant population, along with significant composition shifts in migrants' characteristics, and geographic and employment distributions. Recent migrants are on average older, more educated, more likely to be female, more likely to be married, and more likely to have an urban *hukou*. Regression analysis shows that migration rates increased substantially during this period for all individuals regardless of their education, gender, age, marital or *hukou* status. By employing a simple migration location choice model, we investigate the relationship between *hukou* policy and migration behavior. We find that larger and more developed cities are more attractive to migrants but tend to set more stringent *hukou* restrictions. Rural migrants are significantly more deterred by *hukou* restrictions relative to urban migrants. These findings suggest that institutional factors, such as the *hukou* system, are important for understanding the observed patterns in China's labor migration.

Keywords Labor migration · *Hukou* · China

Introduction

China has experienced a dramatic increase in internal labor migration since the early 1990s. While there were only 18 million migrants in 1990, the size of total migrants

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increased to 76 million in 2005 (Table 1).[1] China's internal migration reflects the country's fundamental demographic and social transformations and is an important driving force of China's rapid urbanization and economic growth (Chan and Hu 2003; Bosworth and Collins 2008). It is widely believed that the evolving *hukou* (household registration) system has had a profound impact on China's internal labor migration patterns. However, one major difficulty of assessing the impact of changes in the *hukou* system is that, concurrently with the institutional reform since the 1980s, other fundamental socioeconomic changes have occurred in China. For example, on the supply side, the rural reforms of the late 1970s and early 1980s increased agricultural productivity substantially and generated significant surplus of rural labor (Lin 1992; Zhao 2004). On the demand side, the development of township village enterprises (TVEs) and urban private and informal sectors increased the demand for migrant labor. Thus, a comprehensive assessment of the impact of *hukou* system reforms and socioeconomic changes on migration behavior remains a challenging research topic.

In this paper, we first briefly describe the evolution of China's *hukou* system from its establishment during the central planning era to its reforms since the mid 1980s and discuss the *hukou* system's remaining influence today. We identify various government guidelines and regulations, focusing on the timing of policy changes and regional variation. With the policy environment as background, we document China's changing patterns of internal labor migration between 1990 and 2005, by using micro data from the 1990 and 2000 Chinese censuses and the 2005 1% National Population Survey. More specifically, we first document a drastic increase in the size of migrant population, from 18 million in 1990 to 76 million in 2005, along with significant composition shifts as migrants have become more likely to be female, hold an urban *hukou*, and migrate for a longer duration. We compare the age, education, marriage, employment, and geographic distributions of migrants from each survey, and analyze the changes in migration patterns by gender, by *hukou* status, and by migration duration. Using a regression approach, we show that migration rates increased substantially between 1990 and 2005 for all individuals regardless of their education, gender, age, marital or *hukou* status.

By employing a simple migration location choice model, we investigate the relationship between *hukou* policy and migration behavior. We find that larger and more developed cities are more attractive to migrants but tend to set more stringent *hukou* restrictions. Rural migrants are significantly more deterred by *hukou* restrictions relative to urban migrants. Although our analysis cannot completely separate the effects of China's *hukou* system on migration behavior from the effects of other socioeconomic factors, our findings suggest that the *hukou* system is important for understanding the observed patterns of internal labor migration in China.

Our study differs from the existing literature on China's labor migration in that we are able to systematically document trends in labor migration between 1990 and 2005 by demographic characteristics and regions with comprehensive microdata. This paper also contributes to the literature that assesses the impact of China's *hukou* system. The existing literature either focuses on the effects of the *hukou* system on

[1] All references to migrants in this study include individuals between the ages of 16 and 65, who live in counties other than where they register their *hukou*.

income inequality (e.g., Liu 2005; Whalley and Zhang 2007) or on the aggregate implication of the *hukou* policy on labor allocation inefficiency and industrialization (e.g., Au and Vernon Henderson 2006; Brandt et al. 2008; Ngai et al. 2018). But there exists limited empirical evidence on the relationship between China's *hukou* reform and individual migration decisions. Bao et al. (2011) is one of the few exceptions that directly investigates the link between the *hukou* control and labor migration at provincial level. Unlike Bao et al. (2011), we focus on migration choice at city level rather than at provincial level as there exist substantial variations in economic conditions and *hukou* restrictions within provinces. We also highlight how different demographic groups might respond differently to local *hukou* restrictions.

The rest of the paper is organized as follows. Section "China's *Hukou* System" provides an overview of China's *hukou* system and how it has evolved over time. Section "Descriptive Patterns of China's Internal Migration" introduces the census data and documents the long run trends in China's internal labor migration. Section "Location Choice of Migrants and *Hukou* Policy" investigates the relationship between the observed labor migration patterns and *hukou* restrictions. The last section presents the concluding remarks.

China's *Hukou* System

The Basics of the *Hukou* System

China's *hukou* system was first set up in cities in 1951 and expanded to cover both rural and urban areas in 1955 as a means to monitor population movements. The first set of *hukou* legislation was promulgated by the National People's Congress in 1958, which granted state agencies powers in controlling people's geographical mobility through a system of migration permits and other regulations (Chan and Li 1999). The rationale for establishing the *hukou* system was to keep most of the population in the countryside, to secure social and political order, and to ensure food provision and industrialization in cities.

Under the *hukou* system, each person is assigned a *hukou* status that classifies both *hukou* type and the residential location attached to the *hukou*. The *hukou* registration type is categorized into "agriculture (rural) *hukou* " and "nonagriculture (urban) *hukou,*" a classification which originated from the occupation division in the 1950s. Loosely speaking, individuals in rural villages are born with an "agriculture *hukou*" whereas those born in cities are assigned a "nonagriculture *hukou.*" During the centrally planned regime, this dual classification determined one's entitlements to state-provided goods and services, including rationed food grain. In addition to one's *hukou* type, each person is attached to his or her place of *hukou* registration based on their presumed regular or permanent residence, such as a city, town, or village. Therefore, in addition to the "agriculture" versus "nonagriculture" *hukou* type, each person is also distinguished by whether he or she has a "local *hukou*" or "nonlocal *hukou*" with respect to a specific residential location. The local *hukou* registration ensures one's rights to access services in a specific locality. A person's *hukou* registration type and location were inherited from his or her mother before 1998, and after

a policy change in 1998 children could inherit *hukou* status from either their mother or their father.

Change of *hukou* registration status (both type and location) is far from a matter of personal choice. In fact, the key to regulating population movements, especially formal rural-to-urban migration, under the *hukou* system is to strictly control *hukou* conversion. For an individual to officially move from a village to a particular town or city, he or she would have to receive approval from the state to convert his or her *hukou* type from agriculture to nonagriculture (a process known as *nongzhuanfei*) first, and then change the *hukou* registration locality. *Nongzhuanfei* was the more critical and most difficult part in this two-step process. The central government set an annual quota of *nongzhuanfei* in each locale and stipulated very stringent criteria for obtaining *nongzhuanfei*. Common *nongzhuanfei* channels included recruitment by a state-owned enterprise, enrollment in an institution of higher education, promotion to a senior administrative job, displacement due to state land expropriation and demobilization to cities for soldiers. In general, the criteria for *nongzhuanfei* were designed to serve the needs of the state (Chan 2009).

During the pre-reform period, a person with an agriculture *hukou* would have serious difficulties living in an urban area without an urban local *hukou* because employment and the allocation of food, housing, and other necessities were all contingent on urban registration, and "undocumented" migrants (without formal *hukou* conversion) would be repatriated by the police. As a result, the overall internal migration rate was very low. According to estimates by Duan et al. (2008), the migrant population size in 1982 was only 6.57 million, accounting for merely 0.66% of the total population.

The *Hukou* System Reform

After the inception of China's economic reform in the late 1970s, national and local authorities began to loosen restrictions on physical movements of rural labor for work in the cities. The *hukou* system has undergone important changes over time, and one of the most significant changes is the shift of power of making *hukou*-related policies from the central government to local governments.

Although rural decollectivization generated a large surplus of rural labor, rural-to-urban migration was tightly controlled until the mid-1980s. In 1984, a major policy reform initiated by the State Council's "Directive Concerning Issues Related to Peasants Settling Down in Market Towns" (*Guanyu nongmin jinru jizhen luohu wenti de tongzhi*) allowed farmers to move to (urban) market towns if they could make their own food grain arrangements, and if they were able to either run businesses or be officially employed and have their own accommodation in the market towns (Chan and Li 1999). In 1988, the government further relaxed the control over labor mobility and began to encourage farmers to move towards the coastal cities. These policies were initially responses to the rapid growth of rural surplus labor and the demand for cheap labor in the Special Economic Zones. Despite these policies, rural-to-urban migration remained extremely restrictive. The migration control policy was adjusted between 1989 and 1991 due to the perceived negative effects of migration on transportation, public security and urban employment. Migrants were classified as "blind flows"

(*mangliu*), and the government deemed it necessary to tighten migration controls. In the 1980s, the adjustments to *hukou* system were overall very limited.

In the 1990s, the central government gradually delegated the power of setting and implementing *hukou* regulations to local governments and issued policies to ease rural *hukou* conversions to small towns and small county-level cities. A policy document "Circular on Implementation of Locally-valid Urban *Hukou* Registration " (*Guanyu shixing dangdi youxiao chengzhen jumin hukou zhidu de tongzhi*) issued by the Ministry of Public Security in 1992 endorsed some local governments' practice to grant "blue-stamp" urban *hukou* to eligible migrants in small cities and towns and special zones in some big cities.[2] The blue-stamp *hukou* program's specific design and implementation were left to local governments. To acquire a blue-stamp *hukou*, a migrant would pay a large lump sum fee of "urban infrastructure construction," which varied greatly across locations. In 1997, the State Council further approved a policy document titled "Pilot Schemes for Reforming *Hukou* Administration System in Small Towns" (*Xiaochengzhen huji guanli zhidu gaige shidian fang'an*) that allowed qualified individuals with a rural *hukou* to receive an urban *hukou* in 450 pilot towns and small cities. Rural *hukou* holders who had stable non-agricultural jobs and regular accommodation in those selected towns and small cities and lived there for more than two years were qualified to apply for urban *hukou* conversion or *nongzhuanfei*. The reform was restricted to small towns and cities where state-provided welfare was very limited. The introduction of the blue-stamp *hukou* and the relaxation of *hukou* control in small towns presented new directions in the management of internal migration by the Chinese government.

A few provinces, including Guangdong, Zhejiang and Jiangsu, began to eliminate *nongzhuanfei* quotas in some cities and all towns and abolish the distinction between "agriculture" and "nonagriculture" *hukou* in the early 2000s. The two *hukou* types were unified into one single category called resident household (*jumin*) *hukou* (Chan and Buckingham 2008). It is important to note that the program to eliminate the agriculture and nonagriculture distinction only applies to *local* population in a number of cities, extending urban benefits to former *local* agricultural population.[3] The *hukou* management was further localized in the 2000s, and many local governments (towns and cities) have gained full discretion to set their own criteria upon which local *hukou* would be granted. Currently, migrants' qualifications for local *hukou* conversion are assessed based on their contributions to investment, tax payment, urban housing purchase, employment status, among others. City governments stipulate their own *hukou* conversion requirements, and cities generally tend to grant local *hukou* status to those who are either rich (able to purchase urban housing or make large investments) or have higher skills (usually with a education degree or professional qualification).

[2]"Blue-stamp" urban *hukou* is granted by local authorities and is valid only locally. It is distinguished by a blue stamp, as compared to a red stamp that is carried by a formal urban *hukou* on the *hukou* registration book.

[3]To obtain urban *hukou*, farmers have to give up their land-use rights, which may provide more financial benefits in an urbanizing region. Critics of this program argue that the government unfairly appropriates farmers' property during the process.

The Current State of the *Hukou* System

In the post-reform era, the most substantive change of the *hukou* system has been the relaxation of physical controls on migration. These policy changes were at least in part responses to the increasing demand for unskilled labor in China's export-oriented manufacturing sector and urban informal sector since the 1990s and especially after China's accession to the World Trade Organization (WTO) in 2001. Having an agriculture or nonlocal *hukou* no longer directly restricts people to move. In coastal cites specializing in export-processing industries (such as Shenzhen), migrant workers easily account for greater majority of the labor force. Since the mid 1980s, the *hukou* system has been decentralized and localized. Overall migration control through the *hukou* system, measured by local *hukou* conversion requirements, has decreased in most Chinese cites in the 2000s (Zhang and Lu 2018).

Currently, *hukou* policies tend to be more lenient in small cities relative to large cities. The level and availability of state-provide services (such as education, health care and urban infrastructure) and welfare are highly correlated with the administrative hierarchical rank of a city in China (Cai et al. 2001). Higher-rank (typically also larger) cities generally have higher quantity and quality of services. Thus local *hukou* in big cities is much more desirable, and they are also the major migration destinations. However, big cities tend to impose much more stringent local *hukou* qualification threshold.[4] In recent years, local governments in some large Chinese cities, such as Beijing and Shanghai, are tightening instead of loosening their entry barriers (Zhang and Lu 2018).

Under the current *hukou* system, it is still a person's *hukou* status, rather than where he/she lives and works, that determines his/her access to public service and social welfare. The most important benefit of an agriculture *hukou* is the land-use rights on the piece of land allocated to the *hukou* holder. An agriculture *hukou* is also associated with access to agricultural subsidies and some sort of rural social security programs in recent years (Song 2014). Due to China's urban-biased development strategy, government provision of social services and social welfare is at a very low level in rural areas. For example, rural public schools are usually of low quality and short of funding and staff, and most rural people have no access to retirement pensions or unemployment benefits. A nonagriculture *hukou* is associated with access to local public schools, health insurance, retirement pensions, housing subsidies, unemployment benefits and other social welfare and social services in urban areas. Migrants without local *hukou* often have very limited access to these public service and social welfare. This is especially true for rural migrants as they are less educated and more likely to work in low-paying jobs compared to urban migrants. The benefits associated with nonagriculture *hukou* is considered much larger than those associated with agriculture *hukou* in most places.

The *hukou* system continues to be a major obstacle in preventing migrants from settling in the city, especially in large cities. It divides the Chinese population to

[4]Several recent papers (Sun et al. 2011; Zhang and Tao 2012; Zhang and Lu 2018) compare rules and regulations from local policy documents to analyze the stringency of *hukou* restrictions across different provinces and cities.

segments (rural versus urban, local versus nonlocal) and discriminates based on that. As one of China's fundamental institutional arrangements, the *hukou* system still imposes significant restrictions on population movements and social mobility.

Descriptive Patterns of China's Internal Migration

The Census Data

To examine China's internal migration patterns, we use micro-level data from the 1990 and 2000 censuses and the 2005 1% National Population Survey (also known as the 2005 mini-census) collected by China's National Bureau of Statistics.[5] These data are considered to be the best data sources for identifying migrants in China. They are well suited to describing broad country-wide patterns of internal migration and its changes over time. The censuses and population survey contain basic demographic information, such as an individual's age, gender, education, and marital status as well as information on employment. Therefore we are able to measure changes in the distribution of migrants at disaggregated levels. More importantly, each survey includes a number of questions on *hukou* and migration status. In all of the 1990–2005 censuses and mini-census, each person in a household was asked whether they had *hukou* registration at their current location. Individuals also reported when they moved to their current location, their reason for migration, and whether they had an agriculture or nonagriculture *hukou*. In this study, a "migrant" is defined as a person who reports living in a county that differs from his/her place of *hukou* registration. Thus we focus on cross-county *non-hukou* migration. Each of the three surveys contains data on whether a respondent lives in the county of their *hukou* registration. Therefore, our definition of migrant is consistent across the surveys.[6] For all our analysis, we restrict the sample to individuals between 16 and 65 years old.

[5]We use a 1% sample of the 1990 census, a 0.095% sample of the 2000 census, and a 20% sample of the 2005 population survey. In the 2005 mini-census, certain provinces (such as Guangdong) were oversampled, and therefore the provincial population shares differ from the aggregate population statistics. To correct for this, we reweight the 2005 sample such that the population distribution across provinces after reweighting is consistent with the national and provincial statistics reported in the statistical yearbook for the year of 2005. More specifically, let n^j_{sample} be province j's population share implied by the 2005 population survey and n^j_{agg} be province j's population share reported in the statistical yearbook, we assign a weight $w^j = n^j_{agg}/n^j_{sample}$ to all individuals in province j in the 2005 sample. The reweighting does not change the descriptive patterns or empirical results in any significant way.

[6]Migration is also commonly defined as the separation of *hukou* and residence across township boundaries. The 2000 and 2005 surveys kept track of whether a respondent registered his/her *hukou* in the township and county where they lived, but the 1990 survey only had information on whether a respondent lived in the county of their *hukou* registration. Therefore cross-county *non-hukou* migration can be defined most consistently over time. In addition, for those moving within a county or district, especially urban residents, some of them may be just living in a different neighborhood for work or for school and they may have nothing to do with migration.

Table 1 Changes in numbers of migrants (millions), 1990–2005

		Gender		Hukou status		Duration	
	All	Men	Women	Rural	Urban	Long-term	Short-term
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1990	18.0	10.2	7.8	14.1	3.9	4.1	13.9
(%)	(100)	(56.9)	(43.1)	(78.6)	(21.4)	(22.9)	(77.1)
2000	57.7	30.0	27.8	44.7	13.1	13.3	44.4
(%)	(100)	(51.9)	(48.1)	(77.4)	(22.6)	(23.1)	(76.9)
2005	76.0	38.2	37.8	53.4	22.6	23.9	52.2
(%)	(100)	(50.3)	(49.7)	(70.2)	(29.8)	(31.4)	(68.6)

For each survey year, the first row gives the number of cross-county migrants between 16 and 65 measured in millions for each category, and the second row shows the number of migrants of a given category as a fraction of total migrants

Trends of Migration Size in China

Internal labor migration has grown rapidly as *hukou* restrictions are gradually relaxed since the mid 1980s. Table 1 describes the growth of the total number of *non-hukou*, cross-county migrants between the ages of 16 and 65 from 1990 to 2005, as well as changes in the distributions of migrants by gender, *hukou* status and migration duration. In 1990, the number of migrants was 18 million, comprising 2.3% of the total population of this age group. The size then increased more than threefold in the ten years from 1990 to 2000 to 58 million, which made up 7.2% of the total population in this age range. The 2005 mini-census shows a continual increase in the number of migrants to 76 million.[7]

The second and third columns of Table 1 show changes in the gender composition of migrants. In 1990, less than 44% of migrants were female. Over time, the number of female migrants grew at a higher rate than that of male migrants. Thus female migrants have grown steadily as a fraction of total migrants. Between 2000 and 2005, about half of the total migrants were female. The increasing labor demand in urban manufacturing and service sectors may have contributed to the rise in female migrants.

In all three surveys, respondents have reported whether they had an agriculture (rural) or nonagriculture (urban) *hukou*. The fourth and fifth columns of Table 1 show the composition changes of migrants by *hukou* status between 1990 and 2005. In all survey years, there were substantially more migrants with a rural *hukou* than migrants with an urban *hukou*. In 1990, 14.1 million out of the 18 million migrants, or 79% of

[7]In Appendix Table 10, we show changes in numbers of *non-hukou*, cross-township migrants over time. In 1990, only cross-county migration information was available, but the number of cross-township migrants was 106 million in 2000 and 119 million in 2005, much higher than the cross-county migration size presented in Table 1.

the total migrants, had rural *hukou.* Most of the migrants with rural *hukou* migrated to cities. This is the main reason why China's internal migration is typically characterized as rural-to-urban migration. However, the number of migrants with an urban *hukou* has increased significantly over time, from 3.9 million in 1990 to 22.6 million in 2005. By the early 2000s, the percent of urban migrants increased to nearly 30% of the total migrant population. To paint a more complete picture of China's internal migration, we need to study migrants with both rural and urban *hukou*. Because *hukou* status plays an important role in China, we will analyze migration patterns for migrants with rural and urban *hukou* separately for the rest of our analysis whenever it is possible.

Based on the information on when migrants moved to their current location in the surveys, the next two columns of Table 1 describe the compositions of migrants by migration duration. We differentiate between "long-term" and "short-term" migrants, where "long-term" migrants are defined as migrants who have resided in their current location for more than five years and "short-term" migrant as those who have resided in this location for less than five years. Migrants are often referred as the "floating population" in China, as migration without local *hukou* is implicitly regarded as temporary. However, along with the rising number of migrants, migrants are also increasingly more likely to stay in their destination locations for longer durations. Less than a quarter of all migrants were long-term migrants in 1990, who stayed in their current location for more than five years, whereas by 2005, the fraction of total migrants who were long-term migrants had expanded to nearly one third.[8]

Changes in Migrants' Characteristics

Although the general surge in China's internal migration has been well documented (e.g., Chan 2008; Cai et al. 2008), it is less well known how migrants' characteristics have changed over time and how migration decisions respond to socioeconomic changes and institutional reforms (e.g., *hukou* system reform). Next, we conduct a comprehensive analysis of the evolution of migrants' characteristics on age, education and marital status between 1990 and 2005. We present sample statistics for all migrants and for migrant groups divided by gender, by *hukou* status, and by migration duration.

Age Distribution

Figure 1 shows how the age distribution of migrants has changed over time. In all three survey years, the largest fraction of migrants were roughly in their late teens and early twenties. Migrants between the ages 16 to 25 comprised 49%, 35% and 32% of total migrants in 1990, 2000 and 2005, respectively. The average age of migrants was 29.4 in 1990 and then increased to 30.7 in 2000 and 32.5 in 2005. Migration at younger ages may generate higher lifetime returns to migration. Individuals' age at migration can also influence their adaptation process in host region (Friedberg 1992).

[8]Using a cross-sectional migrant survey data in 2008, Ge (2018) shows that rural-to-urban migrants in the sample on average resided in cities for 8 years.

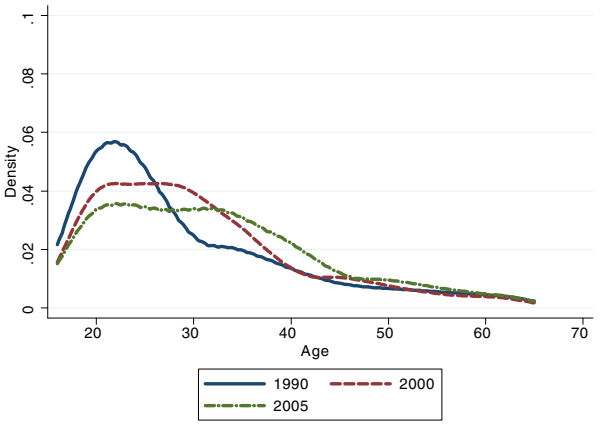
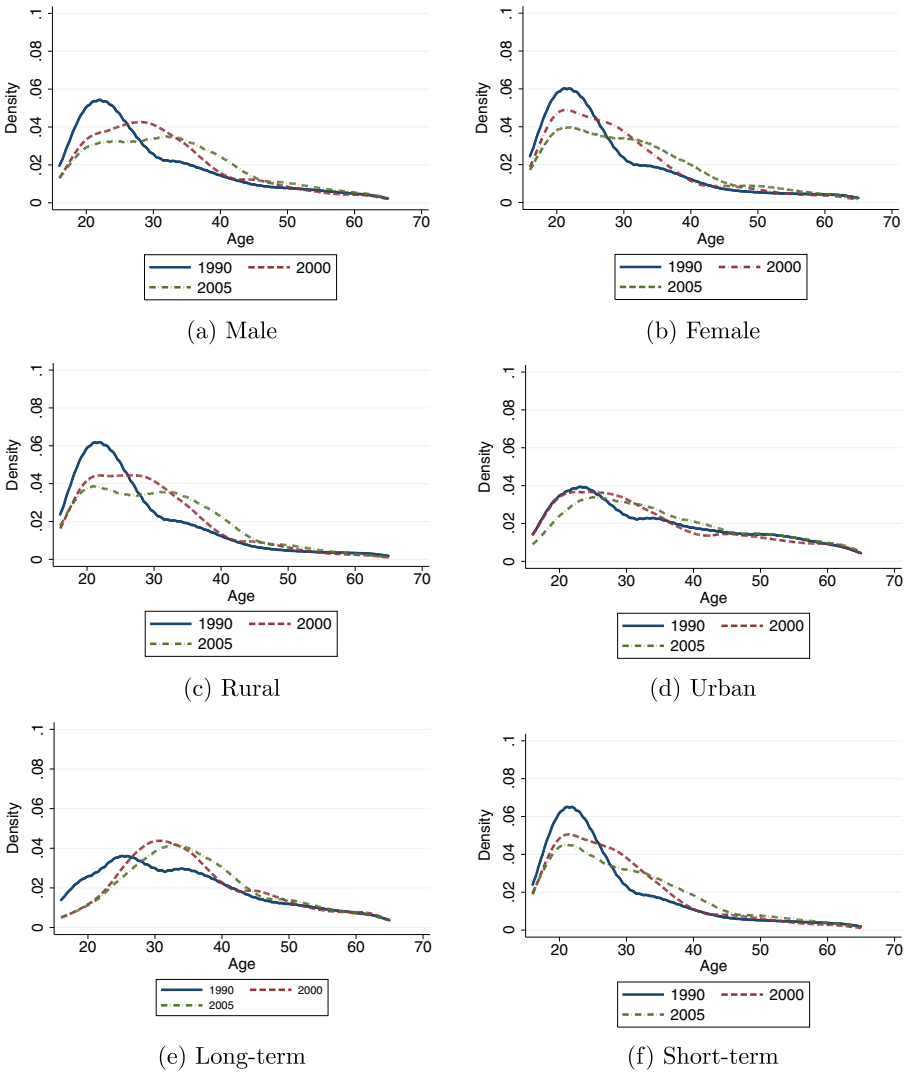


Fig. 1 Age distribution of migrants, 1990–2005

There is evidence that young migrants can better integrate in the urban labor market and earn higher wages than older migrants (Ge 2018). After 1990, migrants became slightly older, with a larger fraction of migrants in their thirties. In 1990, only 18.7% of migrants were between the ages 31 and 40. This proportion grew to 23.0% in 2000 and to 29.6% in 2005. The fraction of migrants above age 40 grew as well, from 16.1% in 1990, to 17.0% in 2000, and to 21.8% in 2005. Over time older people have become more likely to move, and those who have already moved are more likely to stay longer in destination regions. The overall population ageing may also have contributed to the observed shift in migrants' age distribution.

Figure 2 shows how the age density of migrants across gender, *hukou* status and migration duration has changed over time. The top two panels (Panels a and b) present the age densities over time for male and female migrants. In 1990 the age distributions of male and female migrants were very similar, with a large number of both male and female migrants in their late teens and twenties. The age distributions of male and female migrants diverged in 2000 and 2005, with a much larger fraction of females migrating in their twenties compared to male migrants. In 2000 (2005), 40.1% (35.7%) of female migrants were between the ages 16 and 25 as compared to 29.9% (28.4%) of males, and female migrants were on average 1.8 years younger than male migrants (31.6 versus 33.4 years old). A recent study by Kuhn and Shen (2013) shows that employers' relative preferences for female versus male workers are strongly related to the preferred (young) age in China. The gender-specific age preferences may be related to the observed gender differences in migrants' age distribution. Both male and female migrants' age densities have shifted to the right between 1990 and 2005, but male migrants' average age has grown faster.

In the middle two panels (Panels c and d) of Fig. 2 we examine the age distributions of migrants conditional on *hukou* status. In all three survey years, the age densities of urban migrants are considerably flatter than those for rural migrants. Migrants with both rural and urban *hukou* are most likely to migrate when they are young adults in their twenties and thirties. However, urban migrants on average are 4 to 6 years older than rural migrants. Older migrants make up a much larger fraction



(a) Male (b) Female

(c) Rural (d) Urban

(e) Long-term (f) Short-term

Fig. 2 Age distribution of migrants by characteristics, 1990–2005

of urban migrants, with migrants over age 40 comprising 31%, 29% and 33% of urban migrants, compared to 12%, 14% and 17% of rural migrants in 1990, 2000 and 2005, respectively. The differences in age distributions of migrants with different *hukou* status suggest that the *hukou* system still has a significant influence on migration decisions. For those with an urban *hukou*, the costs of migrating to a different place and to settle down in a new region may be lower, and they may have better access to jobs with less strict age requirements. Therefore, they are more likely to move at an older age and stay longer in their destination region.

The bottom two panels (Panels e and f) of Fig. 2 compare the age distributions of short-term and long-term migrants. Not surprisingly, short-term migrants are

much younger than long-term migrants in all three surveys between 1990 and 2005. Individuals in their late teens make up the largest fraction of short-term migrants. In 1990, long-term migrants were relatively evenly distributed across ages. In 2000 and 2005, long-term migrants were disproportionately in their thirties, with migrants aged 30 to 40 making up 33% and 38% of long-term migrants in 2000 and 2005, respectively, compared to 20% and 26% of short-term migrants in 2000 and 2005.

Education Distribution

Next we analyze how the education distribution of migrants has changed over time. We group individuals into four education groups of "primary school," "middle school," "high school," and "college." The category "primary school" includes people with primary school and below education; "high school" refers to both regular and vocational high school; and "college" consists of three-year specialized colleges, four-year universities, and post graduate education.

The results are displayed in Table 2. The first column shows the percent of migrants with each level of education in each of the three survey years. For comparison, the final two columns of the table present the corresponding percentages for nonmigrants. Generally speaking, migrants are more educated than nonmigrants with a rural *hukou*, but less educated than nonmigrants with an urban *hukou*. Over time, education levels have increased substantially for migrants. In 1990, 38% of migrants had a primary school education or less, and by 2005, this number dropped to 21%.

Table 2 Changes in education distribution (%), 1990–2005

	Migrants							Nonmigrants	
		Gender		Hukou status		Duration		Hukou status	
	All (1)	Men (2)	Women (3)	Rural (4)	Urban (5)	Long (6)	Short (7)	Rural (8)	Urban (9)
1990									
Primary school	37.8	32.6	44.8	41.6	23.9	41.6	36.7	64.0	22.0
Middle school	46.3	49.6	41.9	48.1	39.5	41.1	47.8	29.7	37.0
High school	13.6	14.8	11.9	10.0	26.8	15.6	13.0	6.2	31.6
College	2.3	3.1	1.4	0.3	9.8	1.7	2.5	0.1	9.5
2000									
Primary school	25.0	20.8	29.4	29.3	10.2	32.4	22.7	49.0	11.8
Middle school	52.3	53.5	51.0	58.0	32.7	47.5	53.7	43.5	33.2
High school	17.5	19.6	15.3	11.9	36.9	16.0	18.0	7.2	36.6
College	5.2	6.1	4.3	0.8	20.3	4.1	5.5	0.3	18.4
2005									
Primary school	20.8	16.5	25.1	26.5	7.2	25.1	18.8	43.9	11.0
Middle school	48.4	49.8	47.1	57.6	26.9	45.5	49.8	46.4	33.6
High school	19.4	21.1	17.6	13.7	32.7	19.2	19.4	9.0	32.4
College	11.5	12.7	10.2	2.2	33.0	10.2	12.0	0.7	23.0

The proportion of migrants with a college education or more has grown rapidly from 2.3% in 1990 to 11.5% in 2005.

The second and third columns of Table 2 show the distribution of schooling by gender. Between 1990 and 2005 male migrants were substantially better educated than female migrants. The next two columns compare the education distributions of migrants with a rural *hukou* and those with an urban *hukou*. Migrants with a rural *hukou* have much lower education than migrants with an urban *hukou*. For example, only 2% of migrants with a rural *hukou* attended college in 2005, whereas 33% of urban migrants received some college education in the same year. Rural migrants generally are much better educated than nonmigrants with a rural *hukou*, consistent with previous findings on the interaction between education and migration (e.g., Zhao 1999; De Brauw and Giles 2008). In 1990, urban migrants had slightly lower education compared to urban nonmigrants, but since 2000 urban migrants have become increasingly more educated than urban nonmigrants. As we have discussed in the previous section, *hukou* policy has become more localized and leaning towards more educated migrants over time. The sixth and seventh columns of Table 2 show the education distributions of long-term migrants and short-term migrants. Short-term migrants are slightly more educated than long-term migrants on average as they tend to be younger.

Marital Status Distribution

Marital status and family structure are found to have a significant effect on migration decision and the labor market outcomes of migrants (Mincer 1978; Baker and Benjamin 1997). We analyze how the marital status distribution of migrants has changed from 1990 to 2005.

Table 3 shows the proportions of migrants who had never been married, who were currently married, and who were divorced or widowed in each year. Migrants (column 1) are much more likely to be single than nonmigrants (columns 8 and 9), indicating that migration cost may be higher for married people. For example, migrant children are usually without entitlements for free public education in their destination cities (Chen and Feng 2013). The proportion of married migrants has increased over time, from 61% in 1990 to 69% in 2005. This trend may reflect that the relaxation of *hukou* control has made family migration easier over time. However, millions of these migrants left their children behind.[9]

[9]According to a 2013 report from the All-China Women's Federation (2013), 30 million children were left behind and living in the coutryside without their parents. In the censuses and population survey, only women report the number of children they have. There is also no direct information on whether a respondent lives with his/her spouse or children in the data. We have attempted to analyze whether married migrants were traveling with their spouses by using the information on each respondent's relation to the household head. As such, we limit this analysis to respondents who list themselves as the household head or the spouse. Furthermore, only a subset of all household members were interviewed for a large fraction of households in 2005, and thus we limit our analysis to households in which all household members were interviewed for the 2005 sample. For this sample of households, the proportion of married migrants living with their spouses has been roughly constant at 85% between 1990 and 2005, and female married migrants are more likely to live with their spouses than male married migrants.

Table 3 Changes in marital status distribution (%), 1990–2005

	Migrants							Nonmigrants	
		Gender		Hukou status		Duration		Hukou status	
	All (1)	Men (2)	Women (3)	Rural (4)	Urban (5)	Long (6)	Short (7)	Rural (8)	Urban (9)
1990									
Never married	36.7	41.9	29.7	39.0	28.1	20.3	41.5	24.8	23.8
Married	61.4	56.4	68.1	59.2	69.6	77.0	56.8	71.5	73.4
Divorced/widowed	1.9	1.7	2.2	1.8	2.3	2.7	1.7	3.8	2.9
2000									
Never married	36.2	36.3	36.1	36.9	33.9	15.1	42.5	18.6	20.9
Married	62.6	62.7	62.4	62.2	64.0	83.0	56.5	78.1	75.9
Divorced/widowed	1.2	1.0	1.5	0.9	2.1	2.0	1.0	3.3	3.2
2005									
Never married	29.6	31.1	28.2	30.5	27.5	14.5	36.6	18.4	17.4
Married	68.8	67.7	69.9	68.3	69.9	83.3	62.2	78.1	78.8
Divorced/widowed	1.5	1.2	1.9	1.1	2.5	2.1	1.3	3.4	3.8

There were stark differences in the marital status distributions between male and female migrants (columns 2 and 3) in 1990. Male migrants were more likely to be single than female migrants, whereas female migrants were more likely to be married, widowed or divorced. The gender differences in marital status are consistent with the fact that women are much more likely than men to migrate for family reasons, and men are more likely to migrate for work.[10] The gap between men and women has shrunk over time: in 1990 male migrants were 40% more likely as female migrants to be single, whereas in 2000 and 2005 male migrants were only slightly more likely than female migrants to be single.

There are also some differences between the marital status of migrants with a rural *hukou* and those with an urban *hukou* (columns 4 and 5). In all years, urban migrants were much more likely to be married, divorced or widowed than rural migrants. Cities may be more accommodating to urban migrants, and thus family migration is less costly for them. Furthermore, long-term migrants are considerably more likely than short-term migrants to be married (columns 6 and 7), as long-term migrants tend to be older and migrants are more likely to settle down if moving with their family.

[10]The 1990 to 2005 surveys ask migrants about their reasons for coming to their current location. In all three years, most migrants migrate for work related reasons. However female migrants are much more likely than male migrants to move for family reasons such as moving with family or to be with relatives or moving through marriage, with 47%, 22% and 30% of female migrants moved for family reasons in 1990, 2000, and 2005, respectively, compared to 11%, 6% and 11% of men in those three years.

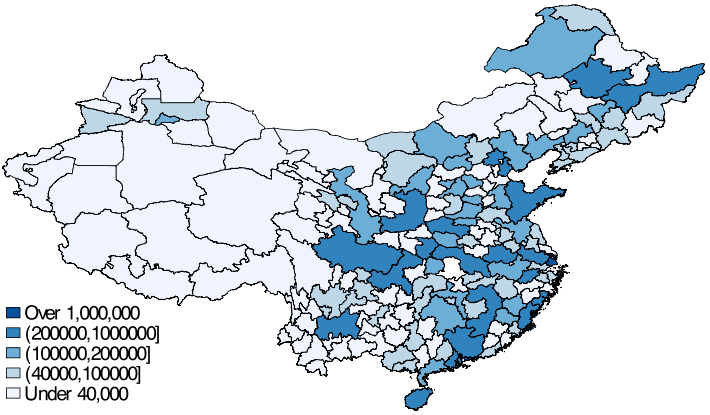
Trends in Geographic Distribution

Regional disparity in wages is one important driving force of internal migration in China (Cai 1999; Zhu 2002; Ge and Yang 2011). Migrants move across different geographic areas, sometimes traveling thousands of miles. The census and mini-census data allow us to examine the national geographic distributions of migrants over time.

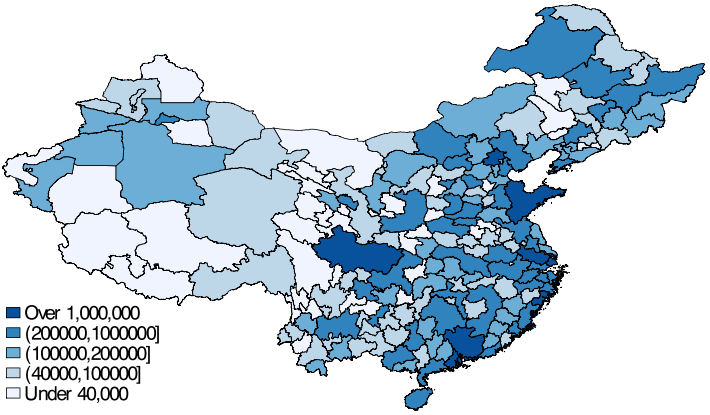
The existing studies on the geographic distribution of China's migrants typically focus on inter-provincial migration flows (e.g., Liang and Ma 2004; Chan 2008). However intra-provincial migration accounted for close to half of total internal migration in 2000 and 2005. We go beyond inter-provincial migration and examine how the geographic distribution of migrants across Chinese sub-provincial regions has changed over time in Fig. 3. Prefecture is an administrative division that ranks below a province and above a county in China's administrative structure. One challenge to construct prefecture-level migration statistics is that prefecture boundaries have changed over time. In this study, we use consistently defined regions constructed by IPUMS International (Minnesota Population Center 2017) as our geographic unit. Changes in prefecture administrative boundaries over time are handled by combining the affected geographic units to create larger, stable units comprised of two or more prefectures. There are 199 consistently defined regions after aggregation, and they do not cross province boundaries and fully nest within provinces.

Figure 3 shows how the number of migrants in each consistently defined Chinese regions evolved between 1990 and 2005. In 1990, most regions had less than 200 thousand migrants. The cities of Shenzhen, Shanghai, Tianjin, and Guangzhou had the highest levels of migration in 1990, but many other coastal cities were not yet major migration destinations. In 2000 and 2005, after China's accession to WTO and becoming "factory of the world," along China's east coast the Pearl River delta and the Lower Yangtze River delta became the prime destinations of migration and many cities in both regions had over one million migrants. Shenzhen, Shanghai, Guangzhou, and Beijing were among the regions with the highest levels of migration these years. In addition, a few major cities or provincial capitals in West and Central China have also become prime destination for migrants. For example, Wuhan, Chengdu, and Kunming had over 500 thousand migrants in 2000 and 2005. Appendix Tables 11, 12 and 13 provide the lists of top 30 cities with the largest number of migrants between 1990 and 2005.

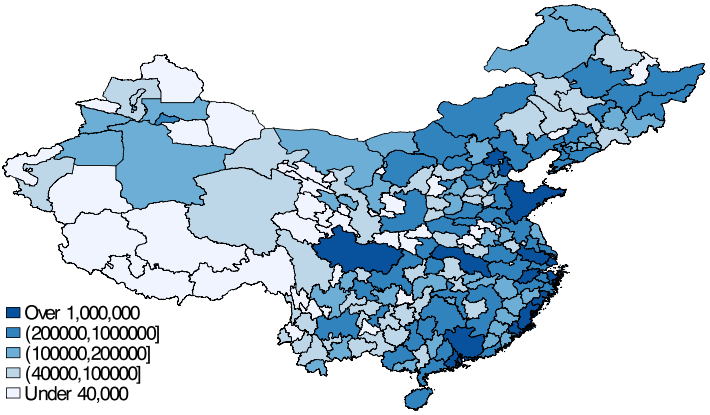
Figure 4 shows the geographic distribution of migrants by *hukou* status between 1990 and 2005. The size of urban migrants was much smaller than that of rural migrants across all regions in 1990, but urban migration size increased more relative to rural migration between 1990 and 2005. In terms of spatial distribution, rural migrants are more concentrated in coastal cities, with cities like Wenzhou, Dongguan, and Zhongshan having the highest rural to urban migrant ratio. In contrast, urban migrants seem to prefer mega-cities like Beijing and Shanghai as well as provincial capital cities such as Wuhan, Nanjing and Chengdu. We have also examined the geographic distribution of migrants by other characteristics such as gender and age but found no significant difference.



(a) 1990



(b) 2000



(c) 2005

Fig. 3 Geographic distribution of migrants, 1990–2005

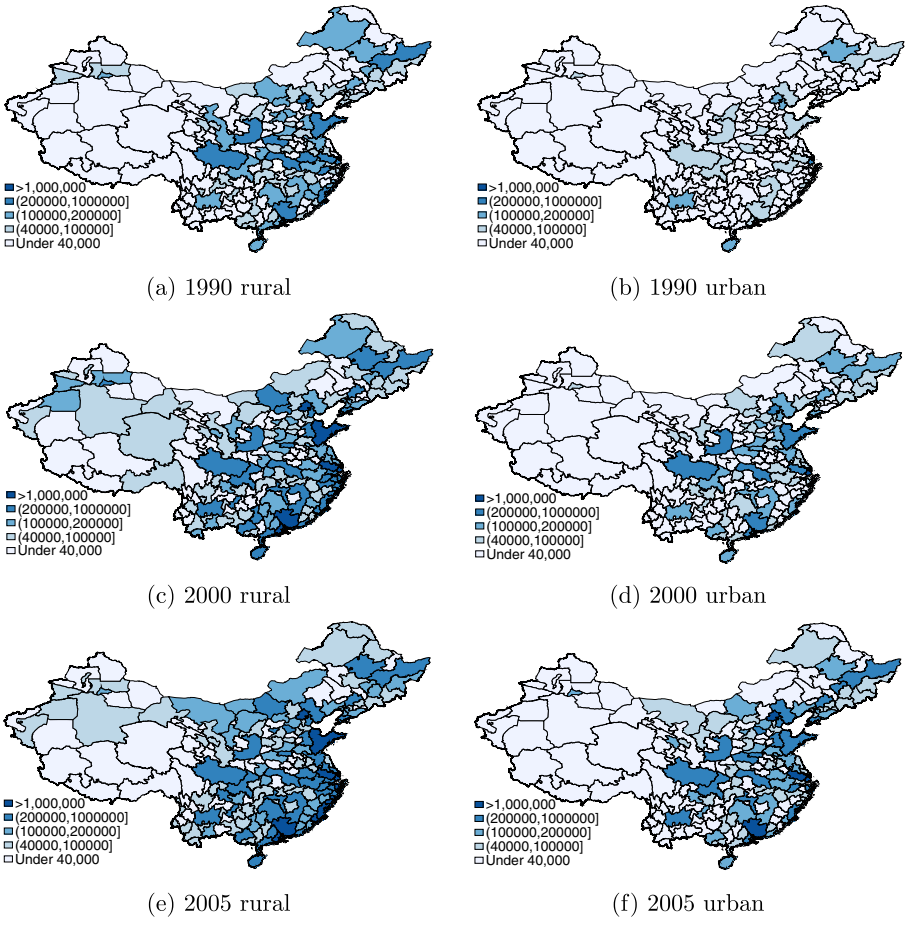


Fig. 4 Geographic distribution of migrants by *Hukou* Status, 1990–2005

Trends in Employment Distribution

Most migrants leave their hometowns for the booming cities in search of more lucrative employment. To investigate how migration interacts with employment, we analyze changes in the employment patterns of migrants from 1990 to 2005. We first examine the employment rates of migrants and then examine how the distribution of migrants across industries has changed over time. For comparison, we also look at the employment rates and industry distributions of rural and urban nonmigrants.

Table 4 shows the percentages for migrants and nonmigrants that were employed in each year between 1990 and 2005. In 1990, we classify those who answered "no" to a question on whether the respondent was nonemployed (i.e., being a student, a homemaker, unemployed, or disabled) as being employed. In 2000 and 2005, those who worked for pay for at least one hour in the week before the survey were classified as being employed. Migrants' average employment rate has declined continuously

Table 4 Changes in employment rate (%), 1990–2005

	Migrants							Nonmigrants	
		Gender		Hukou status		Duration		Hukou status	
	All	Men	Women	Rural	Urban	Long	Short	Rural	Urban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1990	80.6	91.2	66.6	83.3	70.5	72.2	83.0	88.2	74.4
2000	79.8	87.9	71.1	84.8	62.9	72.8	81.9	84.0	60.9
2005	77.7	87.3	68.0	82.8	65.7	74.2	79.3	79.7	58.0

over time, from 81% in 1990, to 80% in 2000 and 78% in 2005. Migrants' employment rates were lower than rural nonmigrants' employment rates, but they were much higher than urban nonmigrants' employment rates.

The second and third columns of Table 4 show that male migrants have much higher employment rates than female migrants. Gender differences in employment rates among migrants are much larger than those among nonmigrants. In addition, migrants with a rural *hukou* have much higher employment rates than migrants with an urban *hukou* (Table 4, columns 4 and 5). In particular, more than 80% of rural migrants were employed in all three years, compared to between 63 to 71% of employed urban migrants. Similarly, short-term migrants are more likely to be employed than long-term migrants.

The census have no information on earnings. Hence we use the distribution of migrants across industries to further investigate their labor market outcomes. Table 5 presents the changes in industry distribution of migrants across surveys. Industries are reported in five broad categories: 1) agriculture, fishing and forestry; 2) mining and construction; 3) manufacturing; 4) basic services, and 5) advanced services.[11] From 1990 to 2005, the proportions of migrants in agriculture, fishing and forestry and mining and construction decreased substantially while the proportion of migrants in the manufacturing and service sectors increased steadily. The fraction of migrants in manufacturing was 29% in 1990 but increased rapidly between 1990 and 2005 as China entered WTO during the time period and manufacturing employment increased dramatically to 46% in 2000 and 42% in 2005. Migrants' employment share in basic service sectors increased continuously, from 19% in 1990, to 25% in 2000 and 28% in 2005, whereas their employment in advanced service sectors fluctuated and changed little over time. In the meantime, rural nonmigrants' industry distribution has been relatively stable (column 8). By 2005, almost 80% of rural nonmigrants still concentrated in agriculture. On the other hand, urban nonmigrants have been moving out of

[11] We group electricity, gas and water in the manufacturing sector. The basic service consists of wholesale and retail trade, hotels and restaurants, transportation, storage and communications. The advanced service sector consists of financial services and insurance, public administration and defense, real estate and business services, education, health and social work and other services.

Table 5 Changes in industry distribution (%), 1990–2005

	Migrants							Nonmigrants	
		Gender		Hukou status		Duration		Hukou status	
	All (1)	Men (2)	Women (3)	Rural (4)	Urban (5)	Long (6)	Short (7)	Rural (8)	Urban (9)
1990									
Agriculture	18.7	13.0	29.0	22.0	4.2	18.6	18.7	89.5	3.9
Mining/construction	22.7	31.9	6.2	20.7	31.4	23.2	22.6	1.3	8.5
Manufacturing	28.6	25.2	34.5	30.2	21.6	21.8	30.3	5.1	38.3
Basic services	19.2	19.7	18.4	19.4	18.4	19.3	19.2	2.3	22.7
Advanced services	10.8	10.2	11.9	7.6	24.4	17.1	9.1	1.8	26.7
2000									
Agriculture	9.4	7.7	11.8	10.4	5.2	17.8	7.2	84.0	6.1
Mining/construction	11.0	17.2	2.7	11.1	10.2	10.8	11.0	2.5	6.5
Manufacturing	46.2	41.6	52.2	48.8	33.9	31.8	50.0	6.6	30.9
Basic services	25.1	25.6	24.4	23.6	31.8	30.1	23.7	4.9	23.5
Advanced services	8.4	7.9	8.9	6.1	18.9	9.5	8.0	2.0	33.1
2005									
Agriculture	6.3	4.7	8.4	7.5	2.7	9.4	4.9	78.6	6.7
Mining/construction	9.1	14.1	2.5	9.7	7.2	10.4	8.5	3.7	6.3
Manufacturing	42.4	39.9	45.6	47.3	27.7	33.3	46.3	8.3	24.6
Basic services	28.0	28.2	27.9	25.8	34.7	31.6	26.5	6.6	25.5
Advanced services	14.2	13.2	15.6	9.7	27.8	15.3	13.7	2.8	36.9

manufacturing sector into advanced service sectors since 1990. Over time, an increasingly larger proportion of migrants worked in the manufacturing sector than urban nonmigrants. The changes in industry distribution for migrants and nonmigrants presented in Table 5 suggest that internal migration has played a crucial role in China's structural transformation.

There exist substantial differences in the industry distributions of male and female migrants (columns 2 and 3). In 1990, female migrants were much more likely than men to be engaged in agriculture, fishing and forestry, with 29% of female migrants compared to 13% of male migrants. As migrants in general have become less likely to be employed in these industries, the difference between men and women has shrunk substantially as well. Male migrants are much more likely to work in the mining and construction industries than female migrants. In addition, migrants with an urban *hukou* are more likely to work in the service sectors, especially advanced service industries, and less likely to work in manufacturing compared to migrants with a rural *hukou* (columns 4 and 5). Similarly, long-term migrants are also more likely to work

in the service industries and less likely to work in manufacturing compared to short-term migrants (columns 6 and 7). Many jobs in the manufacturing sector, such as some assembly jobs, are so-called "3D jobs" (dangerous, dirty, and demeaning jobs). These jobs are considered inferior and undesirable relative to most service jobs. This suggests that rural migrants and short-term migrants are at a more disadvantaged position in the labor market compared to urban and long-term migrants.

Estimates of Conditional Migration Propensity

The aggregate migration trends reported in Table 1 do not control for changes in migration propensity arising from shifts in the characteristics of the population such as gender, age, education, or marital status. A more informative documentation of the migration patterns would show relative migration propensity changes over time, holding the distribution of individual attributes fixed. Thus we specify the following function:

$$M_i^t = \beta_0^t + \sum_k \beta_k^t S_{ik}^t + \sum_a \beta_a^t A_{ia}^t + \beta_f^t G_i^t + \beta_m^t D_i^t + \beta_u^t U_i^t + \varepsilon_i^t, \qquad (1)$$

where M_i^t is a dummy variable on migration status for individual i in survey t, with M_i^t equal to 1 if individual i is a migrant and equal to 0 otherwise; S_{ik}^t are dummy variables for schooling levels with $k \in \{midsch, highsch, col\}$ corresponding to middle school, high school and college education; A_{ia}^t are age dummies; G_i^t is a dummy variable for female; D_i^t is a dummy variable for being married; and U_i^t is a dummy for having an urban *hukou*. The regression coefficients are allowed to vary by survey year in Eq. 1, thus we can analyze whether individual characteristics have become more or less correlated with migration probability over time.

The regression results for each of the three survey years are displayed in Table 6.[12] We find that migration rates increased substantially between 1990 and 2005 for all individuals regardless of their education, gender, age, marital or *hukou* status. The constant term in Eq. 1 is the average migration propensity of the reference group in each year, which refers to single males with a primary school education and rural *hukou* at age 16. It rose from 2.67% in 1990, to 8.16% in 2000 and 7.93% in 2005. Migration probability (conditional on individual characteristics) increased significantly in the 1990s, but became more stable between 2000 and 2005.

Table 6 indicates that the influence of education on an individual's migration decision has grown significantly over time. In 1990, relative to having a primary school or less education, having a middle school education was associated with 1.4 percentage points increase in migration propensity, high school education was associated with 0.8 percentage points increase in migration propensity, and college education was associated with 0.7 percentage points increase in migration propensity. Between

[12] We should interpret the regression results in Table 6 as correlations between individual characteristics and the propensity to migrate, instead of the causal effects of demographic characteristics on the decision to migrate. There may exist omitted variables that are correlated with both migration decision and individual characteristics, and migration decision may affect individual education and marriage outcomes.

Table 6 Estimates of migration propensity

	1990	2000	2005
Constant	0.0267***	0.0816***	0.0793***
	(0.000179)	(0.000986)	(0.000724)
Education			
Middle school	0.0136***	0.0246***	0.0176***
	(0.000153)	(0.000710)	(0.000519)
High school	0.00766***	0.0262***	0.0328***
	(0.000227)	(0.00110)	(0.000804)
College	0.00671***	0.0143***	0.0492***
	(0.000427)	(0.00156)	(0.00118)
Female	−0.00258***	0.000933	−0.000792*
	(0.000113)	(0.000587)	(0.000434)
Married	−0.00802***	−0.0239***	−0.0107***
	(0.000207)	(0.00111)	(0.000797)
Urban hukou	−0.00483***	−0.0238***	−0.00718***
	(0.000163)	(0.000789)	(0.000585)
No. of observations	7,505,404	798,042	1,807,692

Regressions also include age dummies
*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$

2000 and 2005, those with middle school, high school, and college education were 1.8–2.5, 2.6–3.3, and 1.4–4.9 percentage points more likely to migrate compared to those with primary school education.

The coefficients on the female dummy are negative but very small in size in 1990 and 2005. Females were slightly less likely to migrate than males in 1990 and 2005, but men and women with similar characteristics had similar migration propensities in 2000. Being married is negatively associated with migration probability. Conditional on individual characteristics, urban *hukou* holders are less likely to migrate compared to rural *hukou* holders.

Figure 5 plots the estimated coefficients on age dummies, which present the migration propensity over the life-cycle conditional on other characteristics, between 1990 and 2005. All the age coefficients profiles are hump-shaped, indicating that migration propensity is lower for young people below age 20 and older people above 40. In all years, migration rates were highest for people in their 20s. The migration propensity increased dramatically for all ages between 1990 and 2000, whereas the change between 2000 and 2005 was relatively small.

In Table 7, we present estimates of migration propensity by *hukou* type. We run separate regressions for individuals with an urban *hukou* and those with a rural *hukou* while controlling for individual education, age, gender and marital status. For both urban and rural samples, the average migration propensity of the reference group (the

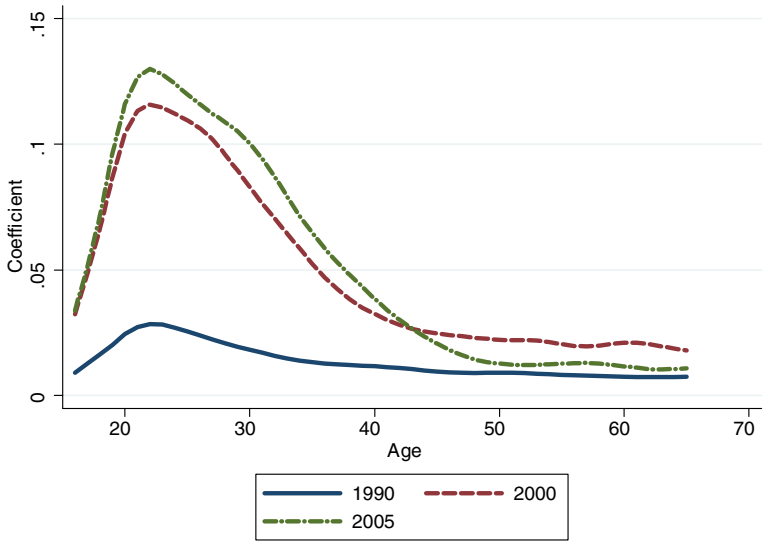


Fig. 5 Estimated coefficients on age dummies

constant term) increased substantially between 1990 and 2005, and females and married individuals tend to be less likely to migrate. One notable difference between the estimates from the urban sample and the rural sample is that the positive influence of education on an individual's migration decision is much larger for rural individuals.

The estimated time effects, captured by the constant terms in Table 6, and the estimated age effects shown in Fig. 5 may be driven by unobserved cohort effects. We use the following age-period-cohort model to estimate age, time and cohort effects on changes in migration probability over time,

$$M_i^t = A_i^t + C_i^t + P_i^t + \beta X_i^t + e_i^t, \tag{2}$$

where M_i^t is a dummy variable on migration status for individual i in survey t, A_i^t is a vector of age effects, C_i^t is a vector of birth cohorts, and P_i^t is a vector of years, and X_i^t is a vector of other control variables including gender, education, marital status and *hukou* status. Because of the linear dependency of age, period and cohort as calendar year equals age plus birth year, we have an identification problem.

We use the intrinsic estimator (IE) described in Yang et al. (2004) to estimate the model with age, time and cohort effects in Eq. 2.[13] The estimation results are shown in Fig. 6. In Panel (a), we show the age effects, which are hump-shaped and have a plateau in the mid to late 30s. Note that in each given year migration rates were highest for people in their 20s (Fig. 5). The difference is driven by the fact that young

[13]More specifically, we use the *apc-ie* command in *stata* to estimate the model in Eq. 2 by using the intrinsic estimator method. An alternative method to estimate the age, time and cohort effects is to impose some explicit restrictions on one of the effects. For example, Deaton and Paxson (1994) identify age and cohort effects by imposing the constraint that the year effects must add up to zero and be orthogonal to a time trend. Yang et al. (2004) compares parameter estimates and model fit statistics produced by the two methods.

Table 7 Estimates of migration propensity by *Hukou* type

	Urban		Rural	
	1990	2005	1990	2005
Constant	0.0301***	0.0885***	0.0273***	0.0790***
	(0.000441)	(0.00180)	(0.000202)	(0.000810)
Education				
Middle school	−0.00467***	0.00645***	0.0161***	0.0141***
	(0.000356)	(0.00140)	(0.000173)	(0.000566)
High school	−0.0105***	0.0202***	0.0166***	0.0371***
	(0.000369)	(0.00147)	(0.000341)	(0.00108)
College	−0.00742***	0.0406***	0.0896***	0.105***
	(0.000482)	(0.00162)	(0.00518)	(0.00430)
Female	−0.00556***	−0.000531	−0.000925***	−0.000885*
	(0.000228)	(0.000847)	(0.000130)	(0.000505)
Married	0.000841	−0.0193***	−0.0119***	−0.00923***
	(0.000442)	(0.00161)	(0.000238)	(0.000915)
No. of observations	1,707,329	537,526	5,798,075	1,270,166

Regressions also include age dummies.
*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$

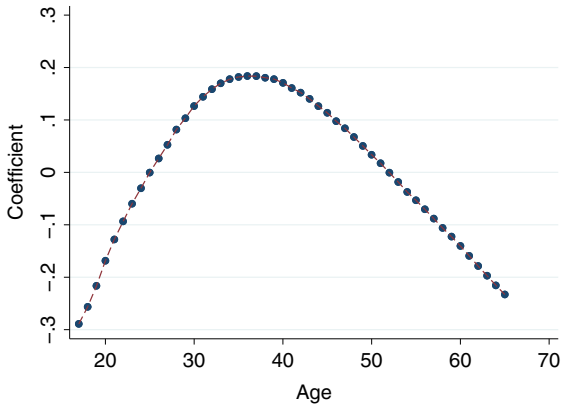
people in each year belong to more recent birth cohorts, who tend to have higher migration propensity. Panel (b) of Fig. 6 shows the cohort effects. There is a clear upward trend in cohort effects for those born after 1955. The cohorts born between 1960 and 1970 have experienced the fastest increase in cohort effects on migration. In Panel (c), we show the year effects, which increase over time, with a slight slowdown after 2000.

Figure 7 shows the age, cohort and year effects on changes in migration probability by *hukou* status. The age effects for both the urban and rural samples are hump-shaped, but the profile for the urban sample is much flatter. The urban age effects (Panel b) do not drop as fast as the rural age effects (Panel a) after age 40. The overall trends of rural and urban cohort effects are similar in Panels (c) and (d) of Fig. 7, but the increase in cohort effects for the rural sample is faster. There also exists notable difference between the time effects by *hukou* status (Panels e and f). The rural time effects slowed down after 2000, whereas the urban time effects accelerated.

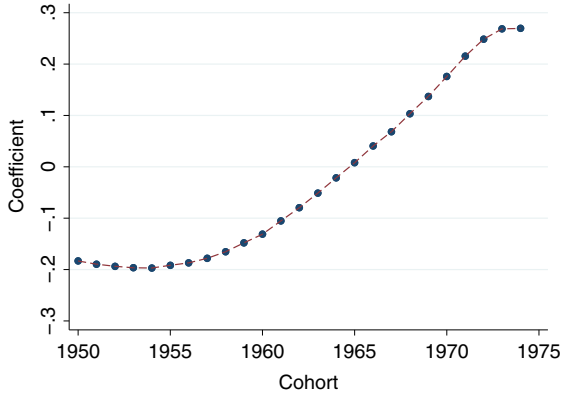
Location Choice of Migrants and *Hukou* Policy

The Model

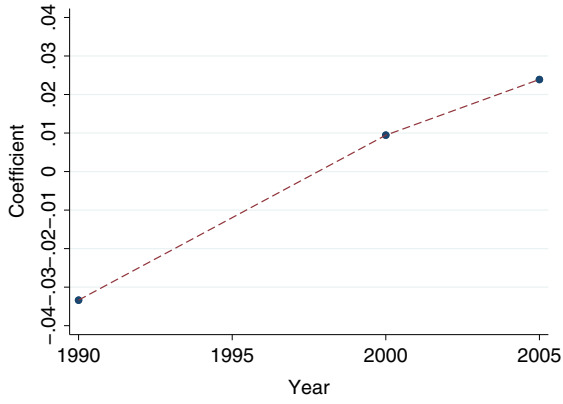
The observed changes in migration behavior over time and by successive cohort are consistent with the anticipated effects of the relaxation of the *hukou* control, but the fundamental socioeconomic changes that occurred in China could also have made



(a) Age effects



(b) Cohort effects



(c) Year effects

Fig. 6 Age, cohort and year effects

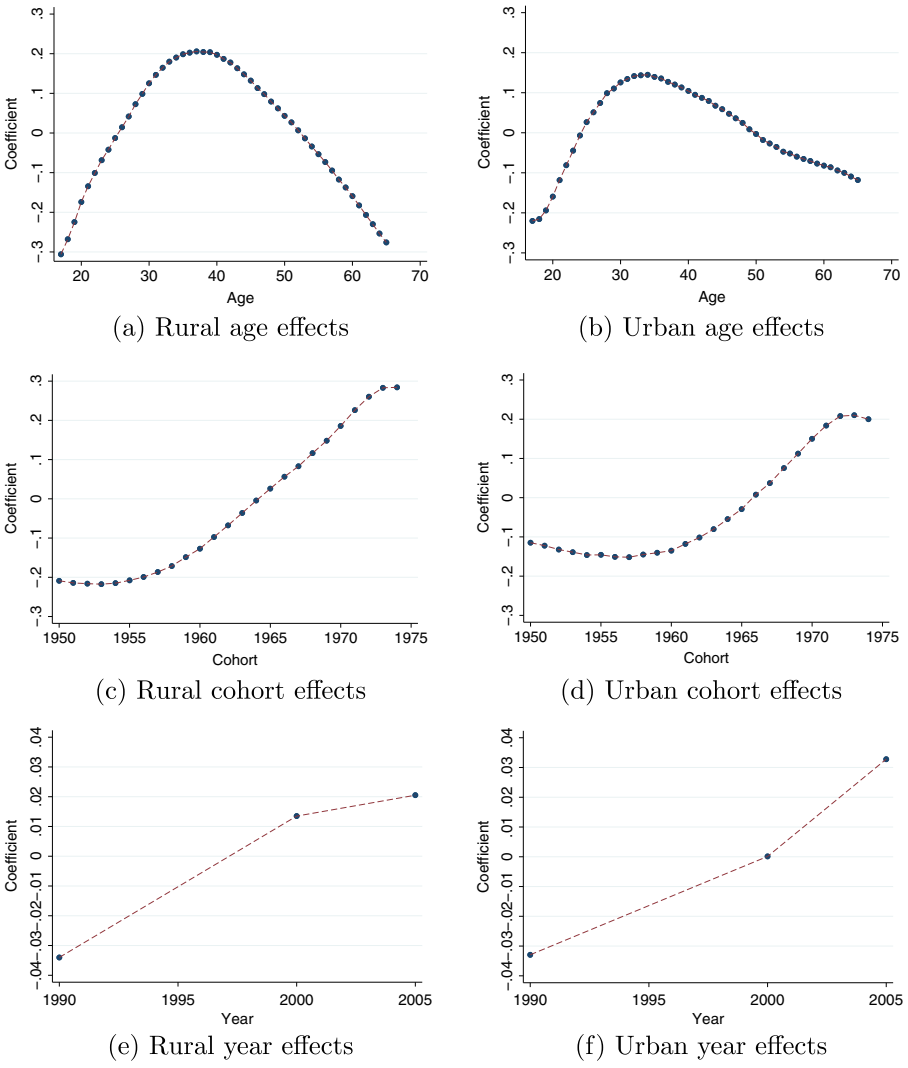


Fig. 7 Age, cohort and year effects by *Hukou* status

important contribution to China's labor migration pattern. Therefore, determining whether the *hukou* policy has an effect on migration behavior is difficult from a simple time-series study. As is described in Section "China's *Hukou* System", the *hukou* policy has become increasingly more localized, and city government stipulate their own *hukou* conversion requirements. In this section, we investigate whether city-specific *hukou* policy at destination affects migration behavior.

We start with a simple location choice model of migrants. Let a potential migrant be indexed by i. Each individual is endowed with a vector of demographic characteristics, which consists of the individual's *hukou* status, gender, and age group. Let

r, f, o be the indicators for rural *hukou*, female, and above age 30, respectively; then each individual's characteristics will be determined by a triple (r, f, o), where $r \in \{0, 1\}$, $f \in \{0, 1\}$, and $o \in \{0, 1\}$.[14] Each individual can choose to migrate to any of the $j \in \{1, 2, \ldots, J\}$ locations/cities or may choose the outside option of not migrating, $j = 0$.

Consider an individual i with demographic characteristics (r_i, f_i, o_i). Let V_{ij} be $i's$ indirect utility from migration to a location j, and V_{ij} is given by:

$$V_{ij} = F_i\left(I_j, X_j\right) + \varepsilon_{ij} = F^{(r_i, f_i, o_i)}\left(I_j, X_j\right) + \varepsilon_{ij},$$

where I_j measures the strictness of *hukou* policy in location j, X_j is a vector of characteristics or amenities in location j (for example, the average wage), and ε_{ij} measures individual i 's idiosyncratic preference for living in location j. In this specification, we allow the function mapping location $j's$ characteristics to mean utility of living in j to vary by the individual's demographics. For example, one might expect that the importance of *hukou* restrictions on migration behavior may depend on the individual's *hukou* status.

We assume that the idiosyncratic preference shock, ε_{ij}, is distributed as extreme-value type 1. Therefore, the probability an individual i chooses to live in location j will be given by:

$$Pr(choice_i = j) = \frac{e^{F_i(I_j, X_j)}}{\sum_{j'=0}^{J} e^{F_i\left(I_{j'}, X_{j'}\right)}}.$$

The total number of individuals of group (r, f, o) who move to location j is given by:

$$M_j^{(r,f,o)} = N^{(r,f,o)} \frac{e^{F^{(r,f,o)}(I_j, X_j)}}{\sum_{j'=0}^{J} e^{F^{(r,f,o)}\left(I_{j'}, X_{j'}\right)}},$$

where $N^{(r,f,o)}$ is the total number of individuals from group (r, f, o). Taking logs yields

$$m_j^{(r,f,o)} = F^{(r,f,o)}\left(I_j, X_j\right) + \gamma^{(r,f,o)}$$

where $m_j^{(r,f,o)} = \log(M_j^{(r,f,o)})$ and $\gamma^{(r,f,o)} = \log(N^{(r,f,o)}) - \log\left(\sum_{j'=0}^{J} e^{F^{(r,f,o)}\left(I_{j'}, X_{j'}\right)}\right)$.

[14] For example, $(r, f, o) = (0, 0, 0)$ corresponds to males with urban *hukou* and below age 30.

Motivated by this model, we consider an empirical specification of the following form:

$$m_{jt}^{(r,f,o)} = \alpha_0 + \alpha_1 I_{jt} + \alpha^r r I_{jt} + \alpha^f f I_{jt} + \alpha^o o I_{jt} + \beta X_{jt} + \beta^r r X_{jt} + \beta^f f X_{jt} + \beta^o o X_{jt} + \gamma_t^{(r,f,o)} + \epsilon_{jt}^{(r,f,o)}. \quad (3)$$

The dependent variable is the log of the number of migrants with characteristics (r, f, o) in location j at time t. In this model, the geographic distribution of migrants depend on the city-specific *hukou* policy at time t $\left(I_{jt}\right)$, and city characteristics $\left(X_{jt}\right)$. We include the interaction terms between I_{jt} and X_{jt} and individual characteristics (r, f, o) to allow individuals with different characteristics to respond differently to *hukou* restrictions and city characteristics. The variable $\gamma_t^{(r,f,o)}$ is a group-specific time trend, and $\epsilon_{jt}^{(r,f,o)}$ is the error term. Therefore, the parameter α_1 measures the correlation between the number of young urban male migrants and the *hukou* index at the city level. The coefficients on the interaction terms α^r, α^f, and α^o measure the differential effects of local *hukou* restrictions on individuals with a rural *hukou*, on females, and on individuals over age 30. Similarly, the coefficients β^r, β^f, and β^o measure the differential effects of city characteristics on individuals with different *hukou* status, gender, and age.

We use 2000 census and 2005 mini-census to estimate the model in Eq. 3. Our goal is to examine how *hukou* policy affects migration behavior by exploring the cross-sectional variations in the stringency of *hukou* control at city level. We use the *hukou* index for 120 Chinese cities constructed by Zhang and Lu (2018) to measure the stringency of *hukou* control at migration destination and investigate how the city-level number of migrants respond to the *hukou* index.[15] The *hukou* index used in this study is constructed based on city-level policy documents on requirements for local urban *hukou* conversion between 2000 and 2014, thus there is no time variation in the *hukou* index between 2000 and 2005 in our data. Other city-level controls $\left(X_{jt}\right)$ include city average wage, size of non-migrant population, foreign direct investment (FDI) per capita, GDP per capita, and fixed asset investment per capita in each year.

The main challenge to study the effect of *hukou* policy to migration behavior is that the stringency of *hukou* control is not set randomly and may be correlated with city characteristics. Larger and more developed cities, where demand for local *hukou* is the highest, tend to set higher entry barriers. In our city-level data, the *hukou* index is positively correlated with city average wage, GDP per capital, population size and other amenities. While we control for a wide range of local variables that might affect

[15] Bao et al. (2011) use two alternative measures of *hukou* restrictions: (1) the fraction of previous migrants who secured a local *hukou*; and (2) the fraction of previous migrants who secured a local *hukou* and local employment. We believe our measure is more likely to reflect the actual policy differences across cities, as we do not rely on realized (migration) outcomes that respond to policy differences.

migration decision in Eq. 3, I_{jt} may still be correlated with some unobserved city characteristics. Suppose the true model is given by

$$m_{jt}^{(r,f,o)} = \alpha_0' + \alpha_1' I_{jt} + \alpha^{r'} r I_{jt} + \alpha^{f'} f I_{jt} + \alpha^{o'} o I_{jt} + \beta' X_{jt} + \beta^{r'} r X_{jt} + \beta^{f'} f X_{jt} + \beta^{o'} o X_{jt} + \sigma_t^{(r,f,o)} + \eta_{jt} + e_{jt}^{(r,f,o)},$$

where η_{jt} is an omitted city amenity that influences migration choice. If the omitted variable η_{jt} is positively correlated with the *hukou* index I_{jt} such that

$$\eta_{jt} = a + cI_{jt} + u_{jt},$$

where $c > 0$, then our estimates of α_1 in Eq. 3 will be upward biased and give an estimate of $\alpha_1' + c$. However, as long as the unobserved factor η_{jt} influence the migration decisions of all individuals regardless of their demographics, the coefficient estimates on the *hukou* index interaction terms $\left(\alpha^r, \alpha^f, \alpha^o\right)$ will still be unbiased estimates of the true parameters $\left(\alpha^{r'}, \alpha^{f'}, \alpha^{o'}\right)$. In this case, the coefficients on the interaction terms recover the differential effects of *hukou* restrictions on various demographic groups relative to young men with an urban *hukou*.

Furthermore, we also explore the role that *hukou* restrictions play on the growth of migrant population, while we control the changes in city characteristics. We estimate the following equation:

$$\Delta m_{jt}^{(r,f,o)} = \alpha_0 + \alpha_1 I_{jt} + \alpha^r r I_{jt} + \alpha^f f I_{jt} + \alpha^o o I_{jt} + \beta \Delta X_{jt} + \beta^r r \Delta X_{jt} + \beta^f f \Delta X_{jt} + \beta^o o \Delta X_{jt} + \gamma_t^{(r,f,o)} + \epsilon_{jt}^{(r,f,o)}. \quad (4)$$

In this specification, the coefficient α_1 measures the relationship between *hukou* restrictions and changes in migrant population, the coefficients α^r, α^f, and α^o measure the differential effects of *hukou* restrictions on changes in the number of migrants of different *hukou* status, gender and age, whereas the coefficients β^r, β^f, and β^o measure the differential effects of changes in city characteristics on migration growth.

Estimation Results

The estimation results of Eq. 3 are reported in Table 8.[16] The first column shows the results when we do not include any city characteristics. We find that the number of migrants in each city is strongly associated with the *hukou* index, confirming that the *hukou* index is correlated with city characteristics that make a location more attractive. In the second column, we include log city average wage and its interactions with demographics as additional controls. As expected, a city's migration level is strongly correlated with its average wage. The coefficient on *hukou* index remains positive and statistically significant after including average wage, but much smaller in size. The coefficient on the *hukou* index interacted with *rural* migrants is significantly negative and of a significant magnitude. This result suggests that individuals with a rural *hukou* are relatively more deterred by more stringent *hukou* restrictions. We find no

[16] All regressions are weighted by city population in 1995. The unweighted results are qualitatively similar.

Table 8 Effects of *Hukou* on migrant location choice

	(1)	(2)	(3)	(4)	(5)	(6)
Hukou index	8.641***	5.106***	3.326***	3.413***	3.527***	3.533***
	(0.948)	(0.828)	(0.730)	(0.690)	(0.554)	(0.557)
×rural	−0.373	−1.793**	−1.128	−1.074*	−1.077**	−1.109**
	(0.939)	(0.794)	(0.702)	(0.644)	(0.518)	(0.520)
×female	−0.0914	0.0861	0.0457	−0.0111	−0.0119	−0.0404
	(0.939)	(0.793)	(0.701)	(0.644)	(0.518)	(0.520)
×old	−0.893	−0.409	−0.518	−0.552	−0.539	−0.486
	(0.939)	(0.794)	(0.702)	(0.644)	(0.518)	(0.521)
Log wage		2.086***	2.148***	1.460***	0.582**	0.580**
		(0.285)	(0.266)	(0.282)	(0.285)	(0.288)
Log local population			0.675***	0.632***	0.650***	0.650***
			(0.0925)	(0.0906)	(0.0956)	(0.0947)
Log FDI per capita				0.207***	0.0841**	0.0839**
				(0.0406)	(0.0392)	(0.0392)
Log GDP per capita					0.805***	0.798***
					(0.133)	(0.158)
Log fixed asset investment per capita						0.00711
						(0.110)
Observations	1,653	1,653	1,653	1,570	1,570	1,570
R-squared	0.546	0.678	0.721	0.749	0.778	0.778

All regressions include a constant and demographics by year effects. Regressions with city characteristics also include interactions of city characteristics and demographics.
*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$

evidence that *hukou* restrictions have differential effects on migration patterns by gender or age as indicated by the insignificant coefficients on the gender and age interaction terms.

In the next four columns, we sequentially include log local population, log FDI per capita, log GDP per capital and log fixed asset investment per capita as additional controls. While all these variables have positive effects on migration, the estimated effects of *hukou* index are not sensitive to the inclusion of these additional controls. Taken together, we find that the cities with more stringent *hukou* restrictions tend to be more attractive to migrants, even after we control for observed city characteristics. In addition, *hukou* restrictions generate more deterrence to individuals with a rural *hukou* relative to those with an urban *hukou*.

The estimation results of Eq. 4 are presented in Table 9. The first column shows the estimates with no additional controls. The results show that cities with more strict *hukou* restrictions experience faster migration growth as implied by the statistically positive coefficient on the *hukou* index. At the same time, the coefficient on the interaction term between the index and rural *hukou* is strongly negative. We find that

Table 9 Effects of *Hukou* on migration growth

	(1)	(2)	(3)	(4)	(5)	(6)
Hukou index	1.574***	1.587***	1.558***	1.393***	1.515***	1.503***
	(0.364)	(0.340)	(0.342)	(0.364)	(0.382)	(0.372)
×rural	−1.091***	−1.110***	−1.126***	−0.865**	−0.974**	−1.033***
	(0.368)	(0.344)	(0.344)	(0.356)	(0.378)	(0.369)
×female	0.110	0.109	0.111	0.0761	0.0479	0.0312
	(0.368)	(0.344)	(0.344)	(0.356)	(0.377)	(0.367)
×old	−0.0878	−0.0787	−0.0694	−0.183	−0.183	−0.127
	(0.367)	(0.343)	(0.343)	(0.356)	(0.377)	(0.368)
Δ Log wage		0.323	0.329	0.407	0.524	0.527
		(0.343)	(0.340)	(0.352)	(0.383)	(0.380)
Δ Log local population			0.346	0.402*	0.447*	0.448*
			(0.226)	(0.241)	(0.266)	(0.268)
Δ Log FDI per capita				−0.0530	−0.0470	−0.0449
				(0.0600)	(0.0600)	(0.0610)
Δ Log GDP per capita					−0.384	−0.371
					(0.295)	(0.306)
Δ Log fixed asset investment per capita						−0.0168
						(0.114)
Observations	797	797	797	739	739	739
R-squared	0.186	0.196	0.215	0.239	0.244	0.246

All regressions include a constant and demographics by year effects. Regressions with city characteristics also include interactions of city characteristics and demographics.
*** $p < 0.01$,** $p < 0.05$,* $p < 0.1$

more stringent restrictions deter the growth of rural migrant population. We include additional controls on changes in city characteristics in columns 2 to 6 in Table 9, and we find that the effects of *hukou* on migration growth are not sensitive to the additional controls.

Concluding Remarks

This paper uses micro-level data to analyze China's internal labor migration patterns between 1990 and 2005. Migration has increased rapidly since the 1990s. By 2005, the size of China's cross-county working-age migrant population (without local *hukou*) has grown to 76 million. Along with the rise in size, the composition of the migrant population has shifted significantly over time. Recent migrants are on average older, more educated, more likely to be female, more likely to be married,

and more likely to have an urban *hukou*. The increasing proportion of urban migrants shows the importance of considering both countryside and cities as places of origins for migrants. Migrants are also increasingly more likely to stay in their destinations for longer period of time and show intentions to settle in the cities permanently instead of being seasonal (or being the "floating population"). China's coastal regions attracted the largest number of migrants, although several major cities and provincial capitals in western and central China have also become prime destinations for migrants. Migrants' average employment rate has declined continuously over time, but the proportion of migrants in the service sectors has increased steadily.

China's internal migration is closely tied with the reforms of the *hukou* system. Although various changes and new initiatives have been made to the *hukou* system, the current system continues to restrain migrants from settling in their destination cities. We find that larger and more developed cities are more attractive to migrants but tend to set more stringent *hukou* restrictions. Rural migrants are significantly more deterred by *hukou* restrictions relative to urban migrants.

We must point out that the reforms in the *hukou* system represent only one set of factors that influence labor migration. The fundamental socioeconomic changes that occurred in China since the 1990s could have made important contribution to China's labor migration patterns. Further investigation into the interactive relationship between socioeconomic changes and *hukou* policies is essential to understand China's changing internal migration patterns and to provide guidance for future policy reforms.

Appendix

Table 10 Changes in numbers of migrants (millions), 1990–2005

		Gender		Hukou status		Duration	
	All	Men	Women	Rural	Urban	Long-term	Short-term
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1990	18.0	10.2	7.8	14.1	3.9	4.1	13.9
(%)	(100)	(56.9)	(43.1)	(78.6)	(21.4)	(22.9)	(77.1)
2000	105.9	53.9	52.0	61.7	44.2	32.4	73.5
(%)	(100)	(50.9)	(49.1)	(58.3)	(41.7)	(30.6)	(69.4)
2005	118.5	58.4	60.1	71.2	47.3	39.4	79.1
(%)	(100)	(49.3)	(50.7)	(60.1)	(39.9)	(33.2)	(66.8)

For each survey year, the first row gives the number of cross-township migrants between 16 and 65 measured in millions for each category, and the second row shows the number of migrants of a given category as a fraction of total migrants

Table 11 Prefectures with the 30 highest numbers of migrants, 1990

Rank	City	Province	No. of migrants (thousands)	Population (thousands)	Migrant percentage (%)
1	Shenzhen	Guangdong	1009	1379	73.2
2	Shanghai	Shanghai	917	7701	11.9
3	Tianjin	Tianjin	557	5673	9.8
4	Guangzhou	Guangdong	369	4533	8.1
5	Dongguan	Guangdong	331	1198	27.7
6	Beijing	Beijing	288	5341	5.4
7	Hangzhou	Zhejiang	262	4472	5.9
8	Hainan	Hainan	255	3986	6.4
9	Wenzhou	Zhejiang	235	4237	5.5
10	Hefei	Anhui	232	2474	9.4
11	Wuxi	Jiangsu	230	3195	7.2
12	Chengdu	Sichuan	214	7019	3.1
13	Kunming	Yunnan	202	3419	5.9
14	Foshan	Guangdong	195	2077	9.4
15	Wuhan	Hubei	194	4787	4.0
16	Wulumuqi	Xinjiang	184	1116	16.5
17	Sanming	Fujian	174	1660	10.5
18	Beijing	Beijing	162	2887	5.6
19	Zhuhai	Guangdong	156	373	42.0
20	Suzhou	Jiangsu	152	4281	3.5
21	Chongqing	Chongqing	144	10071	1.4
22	Daqing	Heilongjiang	143	764	18.7
23	Hulunbuir	Inner Mongolia	140	2155	6.5
24	Yulin	Shaanxi	139	2195	6.3
25	Nanping	Fujian	139	2564	5.4
26	Nanyang	Henan	138	6514	2.1
27	Pingdingshan	Henan	136	3009	4.5
28	Fuzhou	Fujian	128	3818	3.4
29	Jinan	Shandong	125	4366	2.9
30	Putian	Fujian	118	1733	6.8

Table 12 Prefectures with the 30 highest numbers of migrants, 2000

Rank	City	Province	No. of migrants (thousands)	Population (thousands)	Migrant percentage (%)
1	Shenzhen	Guangdong	5056	5823	86.8
2	Dongguan	Guangdong	4190	5113	81.9
3	Shanghai	Shanghai	3041	10226	29.7
4	Guangzhou	Guangdong	2648	7061	37.5
5	Foshan	Guangdong	1827	3888	47.0
6	Beijing	Beijing	1819	8568	21.2
7	Wenzhou	Zhejiang	1010	5125	19.7
8	Quanzhou	Fujian	868	4434	19.6
9	Chengdu	Sichuan	860	7741	11.1
10	Suzhou	Jiangsu	832	4967	16.8
11	Zhongshan	Guangdong	796	1645	48.4
12	Wuhan	Hubei	721	5660	12.7
13	Hangzhou	Zhejiang	714	4845	14.7
14	Kunming	Yunnan	714	3891	18.4
15	Ningbo	Zhejiang	712	4306	16.5
16	Huizhou	Guangdong	655	2021	32.4
17	Wuxi	Jiangsu	630	3735	16.9
18	Nanjing	Jiangsu	593	4260	13.9
19	Fuzhou	Fujian	490	3931	12.5
20	Xiamen	Fujian	490	1408	34.8
21	Zhengzhou	Henan	473	4448	10.6
22	Tianjin	Tianjin	465	5365	8.7
23	Wulumuqi	Xinjiang	454	1636	27.8
24	Chongqing	Chongqing	448	6201	7.2
25	Dalian	Liaoning	448	4356	10.3
26	Changzhou	Jiangsu	443	2752	16.1
27	Qingdao	Shandong	400	5224	7.7
28	Taizhou	Zhejiang	397	3604	11.0
29	Guiyang	Guizhou	390	2436	16.0
30	Zhuhai	Guangdong	382	845	45.2

Table 13 Prefectures with the 30 highest numbers of migrants, 2005

Rank	City	Province	No. of migrants (thousands)	Population (thousands)	Migrant Percentage (%)
1	Shanghai	Shanghai	5419	13538	40.0
2	Shenzhen	Guangdong	4782	5687	84.1
3	Beijing	Beijing	3948	11571	34.1
4	Guangzhou	Guangdong	3127	7957	39.3
5	Suzhou	Jiangsu	2367	6514	36.3
6	Quanzhou	Fujian	1909	5971	32.0
7	Ningbo	Zhejiang	1771	4910	36.1
8	Dongguan	Guangdong	1727	1971	87.6
9	Foshan	Guangdong	1612	3822	42.2
10	Wenzhou	Zhejiang	1442	5584	25.8
11	Tianjin	Tianjin	1345	7072	19.0
12	Nanjing	Jiangsu	1193	5299	22.5
13	Wuxi	Jiangsu	1160	4403	26.3
14	Hangzhou	Zhejiang	1139	5375	21.2
15	Changzhou	Jiangsu	1037	3818	27.2
16	Wuhan	Hubei	1019	5785	17.6
17	Fuzhou	Fujian	1019	4539	22.5
18	Qingdao	Shandong	927	5698	16.3
19	Huizhou	Guangdong	903	2467	36.6
20	Zhongshan	Guangdong	784	1419	55.3
21	Chengdu	Sichuan	771	7491	10.3
22	Xiamen	Fujian	751	1859	40.4
23	Dalian	Liaoning	702	4183	16.8
24	Shenyang	Liaoning	694	5255	13.2
25	Zhuhai	Guangdong	677	1484	45.6
26	Jiaxing	Zhejiang	663	2807	23.6
27	Kunming	Yunnan	635	3522	18.0
28	Chongqing	Chongqing	587	7243	8.1
29	Changsha	Hunan	574	4735	12.1
30	Jinhua	Zhejiang	573	3364	17.0

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