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A quantitative analysis of *Hukou* reform in Chinese cities: 2000–2016

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Abstract

This paper documents the changes in China's *Hukou* reform before and after 2014 based on a unique data set of *Hukou* policy documents from Chinese cities between 2000 and 2016. We construct a *Hukou* registration index to measure the stringency of local *Hukou* qualification in Chinese cities. There are four main channels for migrants to get local urban *Hukou*: investment, home purchase, talent program, and employment. The requirements of the four channels have large variations across different tiers of cities between the two periods of 2000–2013 and 2014–2016. First-tier and some second-tier cities set high criteria for local *Hukou* registration that have become more stringent over time, while other cities have much lower requirements. The point account system for *Hukou* registration shows that cities have different preferences over workers eligible for local urban *Hukou*. The quantitative measures developed in this paper can be used to study a variety of topics on the social and economic consequences of labor mobility barriers.

KEYWORDS

Hukou registration index, migration, point account system, urbanization

1 | INTRODUCTION

Labor mobility barriers, such as migration cost (Bryan & Morten, in press), credit constraint (Bryan, Chowdhury, & Mobarak, 2014), transportation and commuting (Monte, Redding, & Rossi-Hansberg, 2018), and immigration control (Lessem, 2018) have significant negative impacts on individual/household income, aggregate productivity, spatial allocation of labor, and social welfare. In China, the most notable labor mobility barrier is its *Hukou* system. *Hukou* is defined by one's registration

location (a specific residence) and type (rural or urban). Both the location and type of one's *Hukou* are ascribed at birth (same *Hukou* type as mother or father). *Hukou* status changes from rural to urban, or from one location to another, are only allowed if certain requirements are satisfied. The requirements to get local *Hukou* registration vary significantly across locations. Generally, it is harder to register *Hukou* in more developed cities such as Beijing and Shanghai because *Hukou* holders are entitled to certain public services and usually more developed cities provide better public goods.

China's *Hukou* system was formally established in 1958 as a tool of population and resource control to serve the purpose of social planning and industrialization push. The evolution of the current *Hukou* system in China has undergone several stages since its formation (from the founding of the People's Republic of China to 1958), to development (1958–1978), and then the reform period after 1978. Under social planning prior to 1978 and even during the 1980s, local government played a limited role in *Hukou* reform.[1] The reform since 1978 can be further divided into four phases: 1978–1991, 1992–2000, 2000–2013, and 2014–2016. In 1990s, the government gradually issued policies to allow rural residents to register *Hukou* in small towns. The major changes at the city level began in early 2000s. On the one hand, Guangdong, Zhejiang, and other provinces announced the abolition of *Hukou* quote system for rural to urban *Hukou* change; on the other hand, the state abolished the grain and oil permit system, separating the food supply from *Hukou* registration. Our analysis focuses on the changes in *Hukou* system after 2000.

Hukou registration reform first advanced in small and medium-sized cities since 2000. The intensity and scope of the reform increased and expanded after 2013 under China's new leadership. In March 2014, the "National Urbanization Plan (2014–2020)" emphasizes urban *Hukou* reform to ensure that 100 million non-*Hukou* migrants can get urban *Hukou* registration. In July 2014, the State Council issued "Policies on the Reform of Household Registration System" that further clarifies the plan for a full liberalization of *Hukou* in small and medium cities and more transparent *Hukou* requirements in big cities regarding social insurance participation, residence, and employment conditions. Because of the significant changes after 2014, we separate the *Hukou* reform into two stages of 2000–2013 and 2014–2016. From the spatial dimension, we distinguish different development levels (tiers) of cities because cities' attractiveness varies greatly and leads to salient differences in Hukou registration.

Hukou registration system has a profound impact on national development. Firstly, how to understand and measure the cost of labor mobility is crucial for the spatial allocation efficiency of labor, capital, land and other production factors. This is related to different aspects of the *Hukou* registration system, including registration requirements for different types of workers, preferential policies for investment, home purchase, and housing rental. Secondly, the differences in *Hukou* registration among different regions affect the spatial distribution of national labor resource. Thirdly, the availability of public services directly associated with *Hukou* status affects investment decisions in human capital, inequality, and social development. Finally, the rules of *Hukou* registration in cities can indirectly influence the development of rural areas, including agricultural production, land use, and rural governance.

In recent years, sustainable urban development has become a national strategy for Chinese government to promote the harmonious development of its economy and society. The reform of household registration system plays a central role. China's urban development needs to improve the spatial allocation of labor in order to maximize economic growth and welfare at national level. Currently, *Hukou* registration constraints lead to misallocation of labor resources between rural and urban areas, and among cities. Since the improvement of resource allocation is a dynamic process related to *Hukou* reform, we need to quantify the changes in household registration across cities and over time to facilitate further empirical and policy studies on labor mobility and urban development. In the literature, no empirical measures on *Hukou* registration stringency at the city level are available during the period of 2000–2016, especially after 2014. This study attempts to fill this gap.

Given the large variations across cities, it is challenging to integrate all cities into a single system to construct a single index of *Hukou* registration stringency. The research strategy is to start from the original policy documents through which we construct a database of different formats step-by-step. The complete database can facilitate researchers to use the data according to their needs rather than relying on one simplified index, although that is the focus of current paper.

The specific steps of data construction are as follows. (a) Classify the policy documents into different categories. (b) Read each document carefully and take out the text information according to a unified format into an Excel file by category. (c) Extract the quantitative information in the text information. (d) For the qualitative information regarding *Hukou* registration requirements, construct dummy variables and count the total number of conditions. (e) Compute a *Hukou* registration index for all policy categories of each city in both 2000–2013 and 2014–2016. Eventually, the study compiles around 1,000 policy documents from prefectural, provincial, and national governments. Those documents are digitalized into 3 databases and a data of *Hukou* registration index for 120 cities before and after 2014. The index data consist of four indexes for each subcategory of investment, home purchase, talent program (high-end employment), employment, and a composite index.

We also document the point account system of *Hukou* registration implemented recently in large cities such as Guangzhou and Shenzhen. The channels in *Hukou* registration index and the point system are two different ways of obtaining local *Hukou*. One reason to construct the *Hukou* registration index is that the requirements are not directly comparable across cities. The point system, however, has the advantage for direct quantitative comparison to measure the stringency of *Hukou* qualification, although only among big cities. The point system is supplementary but not a substitute to the *Hukou* qualification system. Moreover, small and medium cities are not allowed to have point system to control *Hukou*.

In the literature, two approaches have been used to measure the stringency of *Hukou* registration at city level. One is to use proxy variables, such as the ratio of the registered population to the *Hukou* population by birth (Cai, Du, & Wang, 2001). The main problem with this approach is its inaccuracy since registered population is generated under the current *Hukou* policy and there is no way to know the potential registration number if there were no *Hukou* restrictions. The other approach is counting the changes in rules or the reforms of various registration policies in a city or province (Kinnan, Wang, & Wang, 2018; Sun, Bai, & Xie, 2011; Zhang & Tao, 2012). The methodology in this paper is similar to the second approach.

Our contributions, relative to the above literature, are the following. First, we construct the Hukou stringency measure for 120 cities covering all different tiers of cities. Moreover, our study covers the period from 2014 to 2016 and identifies the changes before and after 2014. The change since 2014 comes from the significant efforts to push the *Hukou* reform from Chinese governments, very different from reforms in previous years in terms of scale and scope. For instance, when comparing *Hukou* registration index before and after 2014, we find that the first-tier cities have actually tightened their *Hukou* control, instead of loosening the *Hukou* registration. It is true, however, that *Hukou* registration does become easier for most middle and small Chinese cities, even some second-tier cities. Another data contribution is to bring the newly developed point system into the understanding of *Hukou* reform.

The more important value of the data we constructed is for future empirical research. The stringency data can be applied to study quantitatively the impact of *Hukou*. For instance, household registration can be an obstacle to labor mobility (Sun et al., 2011), and has negative impact on cities' agglomeration (Combes, Sylvie, & Li, 2015). Labor mobility caused by registration barriers might decrease migrant workers' housing demand and hinder sustainable urban development (Fan, Mo, & Zhang, 2015). The restrictions might cause supply instability of migrant workers (Yuan, Rong, & Yang, 2015). More review of the *Hukou* system can be found in Song (2014) and Bosker, Brakman, Garretsen, and Schramm (2012).

The stringency data are also useful for a better understanding of the political economy of *Hukou* evolution and the designing ideas behind it. In the social planning era, *Hukou* was more used to promote industrialization by controlling resource allocation. Today, the variation in stringency indices among Chinese cities is more a result of local development strategy and population control in big cities. Local governments use *Hukou* as a tool for city management in order to maintain social stability, compete for development and official promotion. Population control of big cities is part of China's long-term urban development strategy, that is, the so-called "local urbanization" aiming to develop small and medium cities.

The registration index can be interpreted not only as a labor mobility barrier, but also the lack of tolerance in local social milieu and discrimination against rural migrants and low skilled workers. It can be used to examine a variety of topics related to the social and economic consequences of *Hukou* regulations. For example, how does *Hukou* affect a city's ability to attract skilled workers, investment, to stimulate innovation and entrepreneurship (Florida, Mellander, & Qian, 2008)? How does *Hukou* affect the spatial distribution of talents and firms, FDIs, and the impact of trade on regional development (Tombe & Zhu, 2015)? How does *Hukou* distort the city sizes and city size distribution and urban welfare (Au & Henderson, 2006; Desmet & Rossi-Hansberg, 2013)? Theoretical findings on *Hukou* and employment allocations (Ngai, Pissarides, & Wang, in press) can also be put into empirical tests utilizing the quantitative *Hukou* stringency measures in this paper.

2 | DATA

2.1 | Source data

The policy documents come from several sources: databases of laws and regulations including the "Law Star," "Legal Information Network," "Law Library," "Peking University Magic," local public security bureau websites, our field survey and interview with local governments. The researchers read each of those documents three times and extracted all the information that can be standardized. The digitalized information is documented into a file with unified format according to predetermined classification. Finally, we quantitatively process all the information in the file and generate a digitalized and quantitative table that can be used for statistical analysis.

We have collected around 1,000 policy documents issued by central and provincial governments and 251 cities since 1980s. Table 1 shows that the number of documents prior to 1999 is 11.85%, and documents from 2000 to 2013 account for 52.61%, and those released in stage of 2014–2016 account for 35.54%. Some studies have suggested that China's household registration system has been undergoing comprehensive reform since 2000, which is consistent with our observations on the policy documents.

2.2 | Sample selection

The analysis below focuses on a subset of 959 documents from 120 cities[2] issued between 2000 and 2016. The selection of sample cities is mainly concerned with coverage and urban development levels, including different tiers of cities and covering all Chinese provinces and municipalities and major cities.[3] For the regional distribution, there are 48 cities in the east, accounting for 40%; the central region has 35 cities, accounting for 29.17%; 37 cities are located in the west, accounting for 30.83% (see Appendix 1 for the city list).

The distribution of the policy documents from Chinese cities for 2000–2016 is shown in Figure 1. 59.68% of the documents are in 2000–2013 and 40.32% in 2014–2016. It is evident that policies

TABLE 1 Distribution of policy documents

All documents				Documents in 2000–2016			
Year	Number	Percentage (%)	Accumulated ratio (%)	Year	Number	Percentage (%)	Accumulated ratio (%)
1984–1999	93	11.85	11.85	2000	12	1.73	1.73
2000	12	1.53	13.38	2001	29	4.19	5.92
2001	29	3.69	17.07	2002	28	4.05	9.97
2002	28	3.57	20.64	2003	37	5.35	15.32
2003	37	4.71	25.35	2004	20	2.89	18.21
2004	20	2.55	27.9	2005	21	3.03	21.24
2005	21	2.68	30.57	2006	21	3.03	24.28
2006	21	2.68	33.25	2007	20	2.89	27.17
2007	20	2.55	35.8	2008	32	4.62	31.79
2008	32	4.08	39.87	2009	33	4.77	36.56
2009	33	4.2	44.08	2010	41	5.92	42.49
2010	41	5.22	49.3	2011	40	5.78	48.27
2011	40	5.1	54.39	2012	43	6.21	54.48
2012	43	5.48	59.87	2013	36	5.2	59.68
2013	36	4.59	64.46	2014	41	5.92	65.61
2014	41	5.22	69.68	2015	144	20.81	86.42
2015	144	18.34	88.03	2016	94	13.59	100
2016	94	11.97	100				

change more frequently after 2013. Starting from 2014, the state issued two documents on the reform of household registration system: "National New Town Planning 2014–2020" and "Opinions of the State Council on Further Promoting the Reform of Household Registration System." Later in 2016, the state further introduced the "Opinions of the State Council on the Deepening of New Town Construction," "the Thirteen Five-year Plan of National Economic and Social Development" and "On the Settlement of 100 Million Migrants." Under China's new leadership since 2013, central government has promoted the reform of household registration system. Considering these facts, the analysis focuses on the two phases of 2000–2013 and 2014–2016 and makes a comparison.

2.3 | Classifications and data processing

Through the policy documents collected and our field studies in many Chinese cities, we find that the existing channels for qualification of local urban *Hukou* mainly fall into seven categories: investment, tax payment, house purchase, employment, joining relatives, special contributions, and others. Most of these *Huko*u qualifications are designed to attract "good things" to local cities. Investment aims for investors; tax payment is a way to judge individuals' contribution to local economy; house purchase is to stimulate local housing demand; employment fits the labor demand of local economy. Joining relatives, special contributions, and other channels have limited coverage and are not directly related to local economic development. Our analysis focuses on four types of policies: investment (merged with tax payment because of their similarity), home purchase, talent program, and employment, which are also the most essential ones for studying the impact of *Hukou* on migration and urbanization.

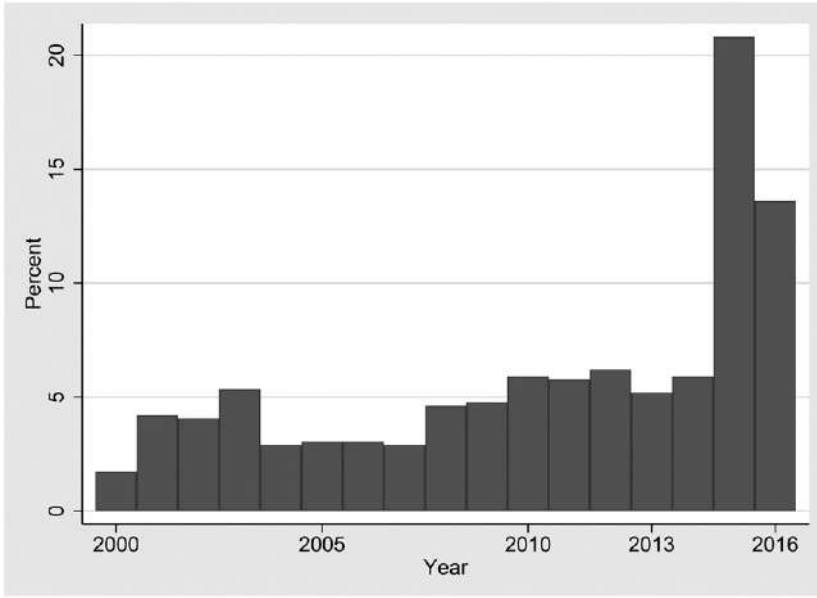

FIGURE 1 Distribution of policy documents (2000–2016)

As an example, we demonstrate for each category what a particular policy document means using policies from Qingdao, one major city (second-tier, vice-provincial level city) in Shandong province. (a) Investment. In 2014, Qingdao government issued a household registration policy stipulating that residents outside Qingdao, who set up an enterprise with more than one million RMB investment, have stable residences and purchased social insurance, can get household registration for themself, spouse, and children (immediate family members). (b) Tax payment. Individuals, who have paid tax over 100,000 RMB a year and paid social insurance for 1 year, can get registration for their immediate family members. (c) House purchase. The buyer of commercial residential unit with a floor area of more than 100 m^2 can get his (her) family *Hukou* in Qingdao. (d) Talent program. Workers with college degree, under the age of 40, and having paid social insurance can get local *Hukou* together with spouse and children. (e) Employment. Migrant workers and their family can get local *Hukou* if the workers have high school degree, a legally stable residence and employment for 3 years, and no criminal record. (f) Relative-dependent. There is no restriction on the age of marriage for spouse to get local *Hukou*. For parents who depend on their children, the father must be over 60 and the mother must be over 55. (g) Special contribution and other channels cover many different special cases and are not common ways to get local *Hukou* registration. For example, "model workers" who obtained the honorary title above the city level can get local *Hukou*.

The channels of *Hukou* qualification have detailed implementation rules that are summarized as the registration assessment index system (see Table A-2 in Appendix 1). We document major changes in *Hukou* registration rules in Chinese cities over the years into both qualitative and quantitative forms that serve as the source data for further analysis. Although we focus on constructing a *Hukou* registration index, researchers need not rely on such an index and can directly use the source data to analyze the changes of household registration according to their research needs. In Appendix 1, Table A-3 presents an example of data processing of policy documents.

2.4 | Summary analysis on *Hukou* qualification requirements

This subsection presents a summary description on requirements for the four types of *Hukou* policies using the extracted quantitative information from the documents. For investment channel, the amount of investment required is higher for more developed cities but appears to converge among cities over time. This indicates that cities have strong preference for investors. As shown in Table 2, the average investment amount required for *Hukou* qualification in first-tier cities (five megacities including Beijing, Shanghai, Guangzhou, Shenzhen, and Tianjin) in 2014–2016 decreases significantly (from 3.4 to 2.6 million), with the slight relaxation of additional conditions. As for the second-tier cities (30 cities such as Hangzhou, Nanjing, Jinan) and fourth-tier cities (30 cities such as Chuzhou, Baoji, Chifeng), the investment amount required declines after 2013, but the number of attached conditions increases. For the third-tier cities (30 cities such as Dongying, Taizhou, Jiaxing), the average investment for *Hukou* qualification has slightly increased but is far smaller than those for first- and second-tier cities and the additional restrictions are reduced.

Table 3 shows that the requirements for *Hukou* qualification through tax payment are similar as the investment channel, in terms of composition and characteristics. Henceforth, the tax payment channel is merged into the investment category in the later analysis on *Hukou* registration index.

Hukou qualification through housing purchase has been popular in Chinese cities, which helps local government to boost the housing market. As shown in Table 4, average area and attached requirements for home purchase oriented *Hukou* qualification in the first- and second-tier cities have not changed much in terms of purchase area, but housing purchase in the first-tier cities has become a necessary but not sufficient condition for *Hukou* qualification. The average area of home purchase in the third-, fourth-, and fifth-tier cities has increased since 2013, with a slight decrease in the number of additional requirements. The average purchase area required in the fourth- and fifth-tier cities is larger than that for more developed cities, however the housing price in more developed cities is much higher and grows much faster since 2005, hence the home-purchase-oriented qualification thresholds in the first- and second-tier cities are much higher in terms of monetary value. As for additional restrictions, the first- and second-tier cities have more requirements.

For the talent program (or high-end employment), Table 5 shows the title (professional skill certificate) and education requirements as well as the attached conditions for *Hukou* qualification. Those in the first-tier cities have increased in 2014–2016. The requirements in other tiers of cities have decreased, with a small change in academic qualifications requirements and additional requirements. Across cities, the qualifications and other attached requirements in first-tier cities are much higher than those in other cities.

TABLE 2 Requirements for *Hukou* qualification through investment

	Investment amount (in 10,000 RMB)		Attached requirements (number)	
City level	**2000–2013**	**2014–2016**	**2000–2013**	**2014–2016**
1st-tier cities	340 (167.3)	260 (89.4)	2 (0.7)	1.8 (0.8)
2nd-tier cities	101 (92.2)	96.3 (101.4)	1.2 (0.8)	1.9 (1.7)
3rd-tier cities	47.2 (58.4)	56.4 (109.8)	3.6 (4.7)	2.2 (3.9)
4th-tier cities	23.8 (45.9)	19.1 (46.7)	0.9 (1.0)	1.1 (1.1)
5th-tier cites	7.8 (12.9)	12.5 (28.1)	0.6 (0.8)	0.8 (1.1)

Note. Standard deviation in parentheses. The total amount of investment is the amount required in the policy document. The attached requirements for investment refer to restrictions on industry, social security payment, and housing conditions.

TABLE 3 Requirements for *Hukou* qualification through tax payment

	Payment amount (in 10,000)		Attached requirements (number)	
City level	**2000–2013**	**2014–2016**	**2000–2013**	**2014–2016**
1st-tier cities	108 (96.2)	112 (93.4)	1.2 (0.4)	1.8 (0.4)
2nd-tier cities	9.0 (10.6)	8.9 (10.6)	1.0 (1.0)	2.0 (1.9)
3rd-tier cities	6.9 (11.3)	5.9 (9.0)	1.6 (1.6)	1.9 (1.2)
4th-tier cities	1.2 (5.5)	1.6 (6.0)	0.2 (0.6)	0.3 (0.7)
5th-tier cites	1.2 (2.0)	1.2 (2.0)	0.5 (0.9)	0.4 (0.6)

Note. Standard deviation in parentheses. The total amount of payment is the amount required in the policy document. The attached requirements refer to restrictions on industry, social security payment, and housing conditions.

TABLE 4 Requirements for *Hukou* qualification through home purchase

	Purchase area (m^2)		Attached requirements (number)	
City level	**2000–2013**	**2014–2016**	**2000–2013**	**2014–2016**
1st-tier cities	88.0 (22.8)	88.0 (22.8)	2.0 (1.0)	1.8 (1.3)
2nd-tier cities	78.2 (24.8)	76.0 (21.7)	1.5 (1.3)	1.8 (2.0)
3rd-tier cities	71.7 (23.3)	80.8 (26.2)	1.5 (1.2)	1.5 (1.6)
4th-tier cities	88.0 (14.0)	96.9 (12.4)	0.8 (0.9)	0.7 (0.7)
5th-tier cites	86.1 (18.4)	92.6 (17.9)	0.5 (0.7)	0.7 (0.5)

Note. Standard deviation in parentheses. The purchase value (area) refers to the specific requirements of the area on the purchase of apartment. The attached requirements for home purchase denote restrictions on the type of purchase, location, duration, operating time.

TABLE 5 Requirements for *Hukou* Qualification for Talent Program

	Title (professional certificate for workers' kill level)		Academic qualification (year)		Attached requirements (number)	
City level	**2000–2013**	**2014–2016**	**2000–2013**	**2014–2016**	**2000–2013**	**2014–2016**
1st-tier cities	2.4 (0.8)	2.8 (0.4)	13.8 (5.0)	15.2 (5.3)	2.2 (1.1)	2.6 (1.5)
2nd-tier cities	1.7 (0.8)	1.6 (0.9)	8.9 (4.7)	9.2 (4.5)	1.4 (1.6)	1.6 (1.8)
3rd-tier cities	1.2 (1.0)	1.0 (1.0)	10.7 (4.4)	11.3 (3.6)	0.9 (1.1)	0.9 (1.1)
4th-tier cities	1.3 (0.9)	1.1 (0.9)	11.0 (3.7)	11.0 (3.7)	1.0 (0.8)	0.8 (0.9)
5th-tier cites	0.8 (0.9)	0.8 (0.8)	10.6 (3.1)	10.8 (2.4)	0.8 (0.8)	0.5 (0.5)

Note. Standard deviation in parentheses. The title requirement (in terms of skill) for junior, middle, and senior professional workers, assigned to 1, 2, and 3, respectively; the academic qualification requirements are clarified into primary and below, junior, high school (including junior college), undergraduate, master and doctor, respectively, assigned to 6, 9, 12, 16, 19, and 23. The attached requirements refer to the existence of labor contract, social security payment, etc.

Table 6 shows that first-tier cities have increased their academic qualification requirements and employment standard for employment-oriented *Hukou* settlement, but reduced years of residence and social security payment in 2014–2016. Overall, the requirements for *Hukou* qualification regarding employment, education, and social security payment in first-tier cities are significantly higher than those in other cities. Thus, it is still very difficult for migrants to obtain local urban *Hukou* in a first- or second-tier city through employment and residence.

TABLE 6 Requirements for *Hukou* qualification through employment

	Academic qualification (year)		Years of employment		Years of residence		Social security participation or payment (year)	
City level	2000–2013	2014–2016	2000–2013	2014–2016	2000–2013	2014–2016	2000–2013	2014–2016
1st-tier cities	14.4 (2.1)	15.2 (1.7)	1.8 (1.0)	2.0 (1.9)	0.6 (0.5)	0.4 (0.5)	3.2 (2.8)	2.6 (3.2)
2nd-tier cities	12.1 (2.9)	10.5 (3.1)	1.4 (1.0)	1.6 (1.3)	0.6 (0.9)	0.5 (0.5)	1.2 (1.1)	1.2 (1.3)
3rd-tier cities	8.5 (3.5)	7.5 (2.6)	1.3 (1.9)	1.3 (0.7)	0.8 (1.0)	1.0 (0.9)	1.0 (1.6)	1.3 (1.2)
4th-tier cities	7.1 (3.0)	6.4 (1.5)	1.1 (1.0)	0.8 (0.7)	0.6 (0.6)	0.9 (0.5)	0.6 (0.8)	0.7 (1.4)
5th-tier cites	7.4 (2.4)	7.2 (2.4)	1.1 (1.1)	0.7 (0.6)	0.7 (0.6)	1.0 (0.5)	0.4 (1.0)	0.7 (0.7)

Note. Standard deviation in parentheses. Academic qualification requirements are clarified into primary and below, junior, high school (including junior college), undergraduate, master and doctor, respectively, assigned to 6, 9, 12, 16, 19, and 23.

3 | *HUKOU* REGISTRATION INDEX OF CHINESE CITIES

3.1 | Methodology

The source data collected and digitalized from the policy documents has nonlinear and non-normal multidimensional features. In order to compare the stringency of *Hukou* registration of different cities objectively in a systematic way, the Projection Pursuit Model (PPM) is used to calculate an index measuring the difficulty of obtaining local *Hukou* for migrants in 120 cities.

PPM is a statistical method to analyze and process non-normal high-dimensional data and can overcome the "curse of dimensionality" problem. The method does not impose subjective assumptions on the data structure and sample size. PPM uses the dimension reduction means to project high-dimensional data to low-dimensional space through the optimal projection that can reflect the structure or characteristic of high-dimensional data. The low-dimensional index is calculated by the projection value of each sample data according to the importance reflected by optimal projection directions, namely the objective weight of indicators (see Friedman and Stuetzle (1982) for methodological details).

The technical details of the computation procedure of PPM are summarized in Appendix 2. Here we summarize the steps and explain the intuition behind the procedure. The first step is to normalize the assessment index for each *Hukou* qualification requirement, such that the scale can be comparable. In the assessment index, the greater the forward index value, the higher the threshold. Secondly, constructing a projection index function synthesizing a p-dimensional data (the different requirements for *Hukou* qualification) into a one-dimensional projection value in order to construct a single *Hukou* registration index. When integrating the projection value, the distribution characteristics of projection value are required that the local projection point should be as dense as possible and it is best to cohesion into a number of points; moreover, projection points between groups should spread out as much as possible. The idea behind this principle is to reduce the data dimension on the one hand and keep the variations in the data on the other hand. Thirdly, optimizing the projection index function to most likely reflect the structural characteristics of high-dimensional data. Finally, sorting the settlement (*Hukou* qualification) threshold value. Bringing the optimum projection direction into the projection value of sample points and sorting the index of each city.

3.2 | Main features of the *Hukou* registration index

Table 7 presents the comparison of the *Hukou* registration index for different tiers of cities. Over time, the registration thresholds in most cities decrease, except the first-tier cities, Beijing, Shanghai,

TABLE 7 Comparison of registration index of different tiers of cities

City	Year	Statistics	Investment	Home purchase	High-end employment	Employment	Composite index
1st-tier cities (5)	00–13	Mean	0.3286	0.2825	0.3167	0.3876	0.5034
		Median	0.2449	0.2691	0.3705	0.4734	0.4867
		Standard deviation	0.1722	0.051	0.0909	0.2588	0.2959
1st-tier cities (5)	14–16	Mean	0.3272	0.2813	0.3173	0.3918	0.7388
		Median	0.2435	0.2582	0.2633	0.2471	0.6461
		Standard deviation	0.1671	0.0957	0.0875	0.2853	0.2163
2nd-tier cities (30)	00–13	Mean	0.0451	0.0334	0.053	0.066	0.1136
		Median	0.0421	0.0223	0.046	0.0517	0.104
		Standard deviation	0.0301	0.0306	0.0343	0.0523	0.0436
2nd-tier cities (30)	14–16	Mean	0.0471	0.0334	0.0575	0.0674	0.1227
		Median	0.0432	0.0182	0.0486	0.0546	0.1196
		Standard deviation	0.0316	0.0363	0.026	0.0381	0.0408
3rd-tier cities (30)	00–13	Mean	0.0547	0.0304	0.045	0.0681	0.1114
		Median	0.028	0.0289	0.0504	0.0553	0.0998
		Standard deviation	0.0627	0.009	0.0384	0.0522	0.0609
3rd-tier cities (30)	14–16	Mean	0.0568	0.0302	0.0408	0.0693	0.1046
		Median	0.0387	0.0318	0.0333	0.0580	0.0867
		Standard deviation	0.0575	0.0083	0.0172	0.0350	0.0580
4th-tier cities (30)	00–13	Mean	0.0472	0.0325	0.0553	0.0721	0.1104
		Median	0.0270	0.0334	0.0524	0.0656	0.1033
		Standard deviation	0.0493	0.005	0.0211	0.0410	0.0423
4th-tier cities (30)	14–16	Mean	0.0414	0.0323	0.0461	0.0643	0.0819
		Median	0.0122	0.0318	0.0324	0.0575	0.0399
		Standard deviation	0.0784	0.0040	0.0343	0.0502	0.0930
Total sample (120)	00–13	Mean	0.0671	0.0442	0.0634	0.0840	0.1343
		Median	0.0363	0.0332	0.0504	0.0572	0.1048
		Standard deviation	0.0877	0.0535	0.0651	0.0979	0.1144
Total sample (120)	14–16	Mean	0.0663	0.0440	0.0607	0.0850	0.1382
		Median	0.0369	0.0337	0.0480	0.0580	0.0971
		Standard deviation	0.0922	0.0561	0.0645	0.0924	0.1501

Guangzhou, Shenzhen, and some second-tier cities. Figure 2 highlights the changes (median) in composite *Hukou* registration index over time across city tiers. The first-tier cities have salient increases and the third to fifth-tier cities experienced salient decreases.

There exists significant difference in *Hukou* registration index among different categories. The high composite threshold indexes of the first- and second-tier cities are caused mainly by high requirements for *Hukou* qualification through employment. This implies that the most prosperous cities in China are tightening instead of loosening their migration control through *Hukou* registration, even after the major push on *Hukou* reform since 2014.

At national level, comparing with 2000–2013, *Hukou* registration indexes for investment, home purchase, and talented workers are all decreased on average during 2014–2016. Hence, the local government has reformed the registration system in order to attract capital, talent, and other scarce resources to promote regional development. In contrast, the requirements for employment on average have been slightly increased. This is rather surprising considering the recent emphasis form central government on granting *Hukou* to migrant workers.

3.3 | Spatial differences in *Hukou* registration index

For the spatial differences, the east has the highest threshold for *Hukou* qualification, followed by the west, while the central region has a generally low threshold (see Table 8). The threshold in the east keeps increasing whereas the threshold in the central and western regions decreases to certain degrees. This pattern is also quite obvious as seen in Figure 3 that shows the median composite index among regions.

We also investigate the difference in smaller region definitions. Overall, cities in China's southwest and northwest regions have relatively low requirement for urban *Hukou* qualification. The registration indexes of cities in northeastern China have been at a low level except big cities like Shenyang, Dalian, and Harbin. The decline of the registration thresholds in the central, southwest, east, and north China, significantly offsets the negative impact from the increasing of registration thresholds in the first-tier cities and some more developed cities in the east. This explains why at the national level the composite *Hukou* index rose slightly from 0.1343 to 0.1382.

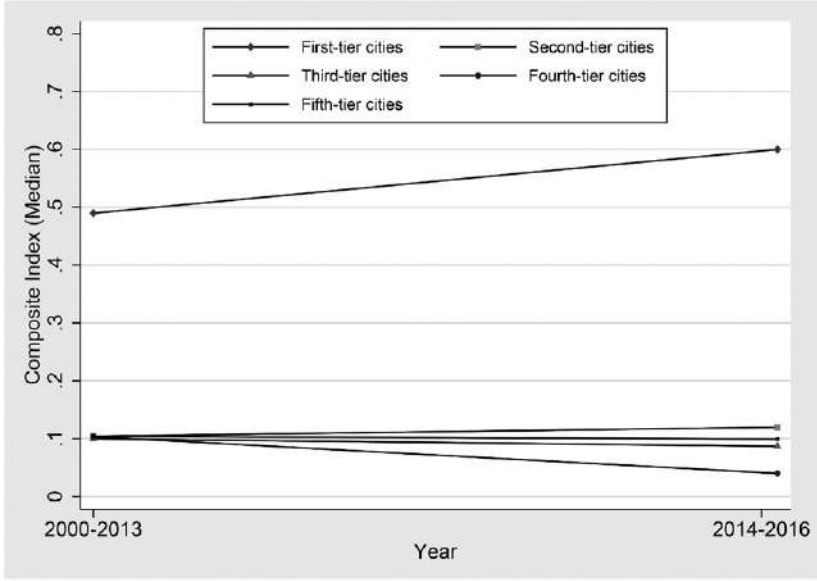

FIGURE 2 Changes in Huji stringency over time across city tiers

TABLE 8 Comparison of registration index of cities in different regions

Region	Year	Satistics	Investment	Home purchase	High-end employment	Employment	Composite index
East (50)	00–13	Mean	0.0932	0.0599	0.0833	0.1084	0.1671
		Median	0.0552	0.0326	0.0567	0.0602	0.1162
		Standard deviation	0.1121	0.0795	0.0900	0.1403	0.1611
East (50)	14–16	Mean	0.0990	0.0603	0.0863	0.1151	0.2017
		Median	0.0492	0.0328	0.0529	0.0842	0.1282
		Standard deviation	0.1148	0.0838	0.0885	0.1315	0.2062
Central (35)	00–13	Mean	0.0269	0.0309	0.0470	0.0657	0.0968
		Median	0.0232	0.0325	0.0426	0.0571	0.1000
		Standard deviation	0.0228	0.0109	0.0342	0.0402	0.0368
Central (35)	14–16	Mean	0.0200	0.0312	0.0407	0.0511	0.0700
		Median	0.0163	0.0336	0.0328	0.0470	0.0707
		Standard deviation	0.0170	0.0103	0.0264	0.0244	0.0278
West (35)	00–13	Mean	0.0700	0.0351	0.0513	0.0675	0.1251
		Median	0.0371	0.0348	0.0524	0.0571	0.1152
		Standard deviation	0.0749	0.0123	0.0316	0.0454	0.0626
West (35)	14–16	Mean	0.0657	0.0335	0.0441	0.0761	0.1158
		Median	0.0467	0.0353	0.0428	0.0575	0.1088
		Standard deviation	0.0817	0.0100	0.0299	0.0420	0.0746

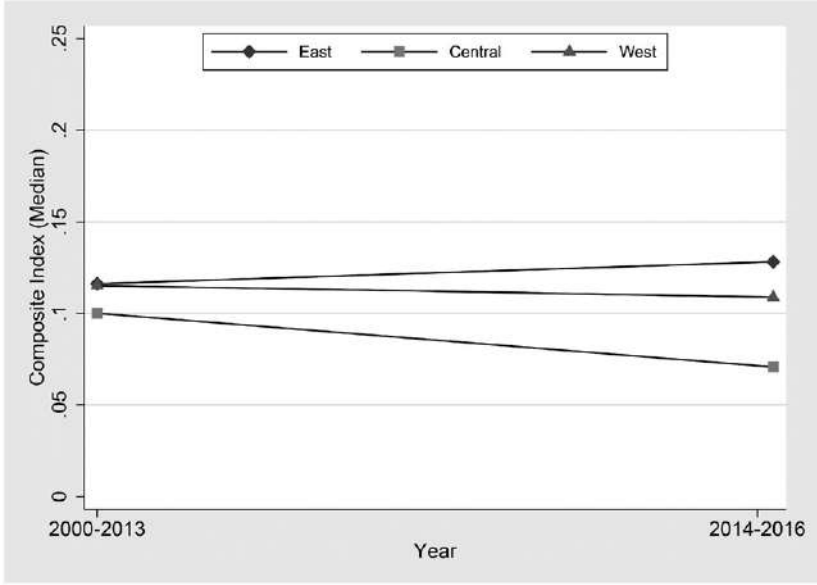

FIGURE 3 Changes in Huji stringency over time across regions

Figure 4 presents the city-level *Hukou* registration index according to different levels of thresholds for *Hukou* qualification in the latest period 2014–2016. Cites with relatively high thresholds in composite registration index are mainly located in the Pearl River Delta, the Yangtze River Delta and the Beijing–Tianjin–Hebei economic zone. The central cities of Midwest China (mainly 17 capital cities) have relatively high requirements for *Hukou* registration as well.

3.4 | Subcategory correlation and individual cities

The registration indexes of different categories are highly positively correlated, especially for the national sample and the first- and second-tier cities. As shown in Table 9, housing purchase has relatively high correlation with investment and high-end employment, which reflects the common rationale among more local governments in more developed cities that is to maximize economic returns using *Hukou* as a tool of selecting migrants. The correlation among the subcategories for lower-tier cities is much lower, which highlight the heterogeneity among those cities in managing *Hukou* registration. Overall, the low-tier cities have much less leverage in advancing their governance objectives through controlling *Hukou* registration because there are smaller number of migrants in their districts and their *Hukou* is not attractive at all because they cannot offer very high-quality public services comparing with high-tier cities.

The composite threshold for *Hukou* qualification in Beijing, Shanghai, Guangzhou, Shenzhen, and some second-tier cities are kept at a high level (see Appendix 3 for a sample cities' indexes; a complete list of the indexes for all cities in the two phases 2000–2013 and 2014–2016 are available from the author). Beijing is the highest (0.8983), followed by Shanghai (0.6834), Guangzhou (0.4867),

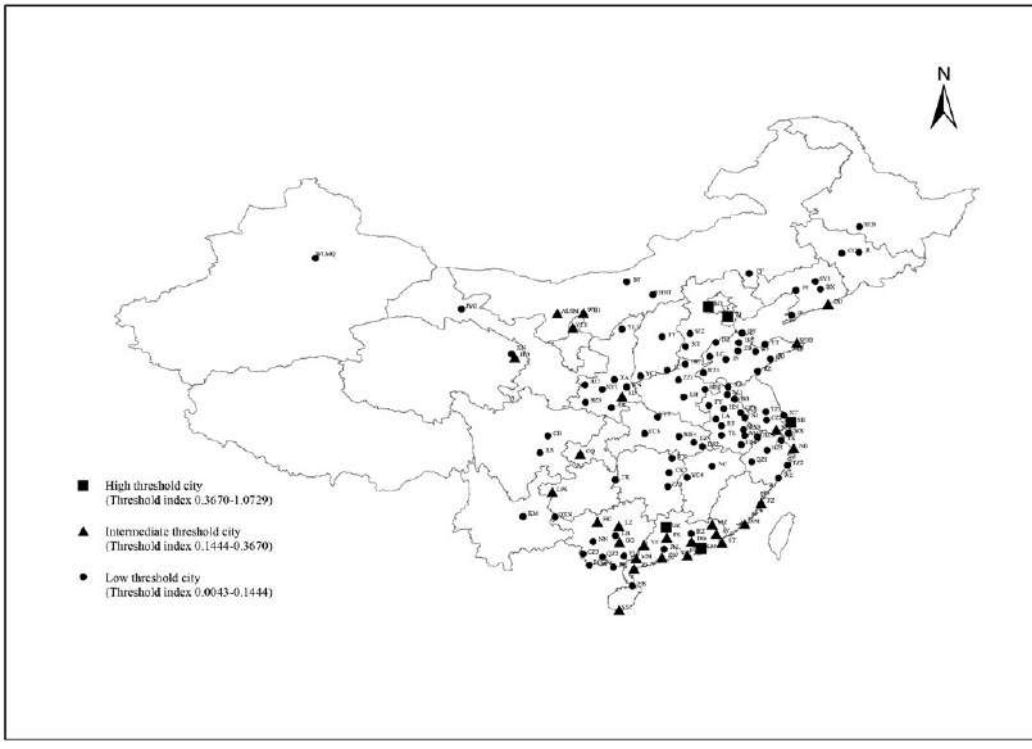

FIGURE 4 The spatial distribution of Hukou registration index: 2014–2016

TABLE 9 Correlation coefficients of registration index for different channels

All cities (2000–2013)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.5828	1		
Home purchase	0.6419	0.5856	1	
High-end employment	0.6031	0.5196	0.7433	1
All cities (2014–2016)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.6280	1		
Home purchase	0.5657	0.6475	1	
High-end employment	0.5395	0.5391	0.6711	1
High-tier (1st-, 2nd-tier) cities (2000–2013)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.7016	1		
Home purchase	0.8274	0.6713	1	
High-end employment	0.7377	0.5529	0.8064	1
High-tier (1st-, 2nd-tier) cities (2014–2016)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.7620	1		
Home purchase	0.7850	0.6891	1	
High-end employment	0.6964	0.5774	0.7219	1
Lower tier (3rd-, 4th-, 5th-tier) cities (2000–2013)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.3740	1		
Home purchase	0.3217	0.0407	1	
High-end employment	0.3561	0.3323	0.2397	1
Lower tier (3rd-, 4th-, 5th-tier) cities (2014–2016)	Investment	Employment	Home purchase	High-end employment
Investment	1			
Employment	0.4614	1		
Home purchase	0.1340	0.0445	1	
High-end employment	0.2958	0.2391	0.1084	1

and Shenzhen (0.279). These numbers are consistent with common observations and thus give more credence to the registration index constructed in this paper.

3.5 | Robustness tests on data selection and methodology

In the sample of 120 cities, some cities did not specify the requirements for each of the four channels of *Hukou* registration; similar cities are used to interpolate the missing part of the data.[4] As a

robustness check, the cities with missing data are dropped and the findings for the remaining 90 cities are consistent with the full sample. In addition, comparison with the results from Wu and Zhang (2010) shows similar patterns for the period from 2000 to 2013.

As for the methodology to analyze high-dimensional data, the entropy method is an alternative. The entropy method is an objective weighting method based entirely on the original data that determines the weight of the indicator in light of the size of the information provided by the observed values (Zhang, An, & Han, 2003). The method is not subject to the interference of subjective assessment and is able to objectively reflect the actual situation of the main assessment. The findings using this method are consistent with the results from the PPM method, except minor changes in the ranking of the registration index. For example, the results of the entropy method show that the cities with the highest index among the 120 cities during 2000–2013 are Tianjin, Beijing, Shanghai, Shenzhen, and Guangzhou, but the results of PPM indicate the cities with the highest index are correspondingly Beijing, Shanghai, Guangzhou, Shenzhen, and Tianjin. The patterns of comparison over the spatial and time dimensions are similar.

The cause for the differences between the two methods is that the entropy method is largely affected by the difference of specific value of various indexes of each city in determining the weight of each assessment index. When the composite *Hukou* registration index is calculated, the determination of the weight of investment, home purchase, high-end employment, and employment is the result of the combined effect of the fluctuation size of various indicators, which leads to the weight given by the index varies from the calculation value of the single registration index. However, the registration index results of investment, home purchase, and other channels calculated by the entropy method are consistent with those of PPM, further illustrating that our registration index for 120 cities is reliable and robust.

4 | THE POINT ACCOUNT SYSTEM FOR *HUKOU* REGISTRATION

From 2010 to 2016, 11 large Chinese cities,[5] like Guangzhou, Shenzhen, and Beijing, have introduced the point account system for *Hukou* registration. Utilizing the policy documents collected, this section compares the rules of point accumulation for migrant worker to be qualified for getting local *Hukou* status. These documents are more comparable quantitatively since each criterion is assigned a number (points) that can be used to compare the stringency of *Hukou* registration requirements across cities. However, the total number of points of qualification in different cities is not the same, so we normalize the points by setting all the total qualification points in all cities equal to 100. Then, we use 100 to normalize all the points in subcategory. The numbers presented in this section are comparable across cities, but those numbers are not the same values as in the original documents.

The point system is not a replacement of other channels for *Hukou* registration discussed in previous sections (see also Zhang (2012) for a discussion on point account system). Moreover, only large cities are allowed by the central government to have the point system. The point system does not mean one can get local *Hukou* automatically if they accumulated certain points; they are also subject to the total quota set by local governments each year.

The point system seems to be effective in most cities. Guangzhou has 6,001 people obtained urban Hukou in 2017 and Tianjin has 4,694 people obtained Hukou in the first half of 2018, through the new point system. Shenzhen has 10,000 quotas for the point system in 2018. Chengdu, Qingdao, and Nanjing all have significant number of quotas for the point system, between 2,000 and 4,000. Beijing and Shanghai did not announce a specific quota yet, although a large group of people are applying for Hukou, for example, the applicants in Beijing by 2018 May were around 120,000.

4.1 | Prerequisites, one-vote veto, and calculation rules

Most cities have set prerequisites (basic requirements) for a worker to be eligible to register in the point accumulation system, including residential permits, social insurance, one-vote veto (criminal record or violation of one-child policy), and stable employment (see Appendix 4). Residence permit is a premise for point accumulation. Ningbo and Qingdao even ask for residence permit for more than 3 years. Social security payment is the basic requirement for all cities. Beijing has the highest requirement on social insurance payment, and those who want to register must pay social security for more than 7 years to have the basic qualification to be in the point accumulation system. Other cities have lower requirements for stable employment. The majority of cities have set up one-vote veto or required to cancel applicants' eligibility if they have a criminal record. Most cities state that if the applicant has violated the one-child policy, participated in illegal organization, provided false information or had a criminal record, the eligibility will be canceled immediately.

The rules of the point accumulation system are mainly composed of the basic items, bonus items, and subtraction items (see Appendix 4). The basic items consist of age, education, skills, stable employment, stable residence, and social security payment period. The bonus items are composed of honor, taxation payment, innovation, and entrepreneurship. The subtraction items contain law violation behavior, breach of honesty and participation in illegal organizations, etc.

4.2 | Age, education, and skills

Age, education, and skills are the key components in evaluating the human capital of a person and its long-term contribution to a city. Local governments are clearly motivated by their short-term growth objectives rather than equity concerns, as discussed in Zhang (2012).

In terms of the point accumulation rules of age (Table 10), systems in Beijing and Qingdao show a singularity feature in point accumulation of age. Specifically, applicants, 45 years old and below, can accumulate 20 points for settlement in Beijing; 35 years old and below are able to get 20 points in Qingdao. The point accumulation rules of age in Shenyang, Shanghai, Nanjing, Haikou, Guangzhou,

TABLE 10 Point accumulation rules of age

City	18–35(years old) and below	36–40	41–45	46–55	56–60	60 and above	Maximum score	Non-standardized score for *Hukou* qualification
Beijing	20	20	20	0	0	0	20	
Guangzhou	6	2.4	2.4	1.2	0	0	6	85
Shenzhen	15	10	5	1	0	0	15	100
Tianjin	14	7	7	0	0	0	14	140
Nanjing	18	13	8	5	5	5	18	100
Haikou	25	25	19	13	13	0	25	80
Ningbo								90
Qingdao	20	0	0	0	0	0	20	100
Guiyang	5	0	0	0	0	0	5	
Shenyang	25	23	19	14	7	4	25	120
Shanghai	25	25	20	8	4	0	25	120

Note. In the table, we take 100 as standardized points to rescale the items, so the score of points is comparable for the same age in different cities. Beijing and Guiyang do not give the standardized settled value, therefore the value for these two cities are not standardized.

Shenzhen, and Tianjin exhibit the feature of declining points with increasing age. The highest score of point accumulation rules of age is between 5 and 25.

As for the point accumulation rules of education (Table 11), the higher the education level, the more points one gets. But the score differences between different education levels vary considerably from cities. In Guangzhou, Shenzhen, Nanjing, Shenyang, and Qingdao, applicants with bachelor's degree will be able to meet or close to the qualification requirements. The points of applicants in Beijing with a Ph.D. degree are 3.5 times of that of applicants with a college degree, and it is 2.2 times in Shanghai. Point accumulation can be largely influenced by Ph.D. degree in large cities such as Beijing and Shanghai. These clearly reflect the development goals of those cities.

The point accumulation through skills is summarized in Table 12. As the level of skill increases, the score that the applicant can obtain rises. In addition to favor the settlement of senior personnel, Qingdao, Tianjin, Guiyang, Guangzhou, and Shenzhen also more emphasize technical personnel to settle down in the city. Shenyang, Shanghai, Nanjing, and Ningbo only prefer for senior talents.

4.3 | Residence, employment, bonus, and subtraction items

The residence and employment favors migrants who also bought a home in the city and those we have worked a longer time so that they could survive and contribute better to city development. In terms of stable residence (see the Table in Appendix 4), the accumulated score of applicants having property is higher than people with legal leasing or living in dormitory. In Shenzhen, Guangzhou, Haikou, and Qingdao, those having residence with its own property rights can gain 20–40 points, and only acquires 1–30 points if having a legal lease or living in dormitory.

As for stable employment, a legitimate and stable job is a prerequisite for obtaining settlement points of stable employment. The longer the duration of the stable job, the higher the score is. Concretely, applicants who have been working for more than one year can earn 3–15 points and gain 10–20 points if for 5 years.

Cities welcome investment, innovation, and entrepreneurship, the greater the amount of investment, the higher the score one can obtain. The more employment one's investment can generate, the

TABLE 11 Point accumulation rules of education

City	Junior	High school/ secondary vocational	Junior college	Bachelor	Master	Ph.D.	The highest point	Non-standardized score
Beijing			10.5	15	26	37	37	
Guangzhou	6	24	71	94	106	118	118	85
Shenzhen	0	30	60	80	90	100	100	100
Tianjin	0	14	21	29	29	29	29	140
Nanjing	0	40	60	80	100	140	140	100
Haikou								80
Ningbo	0	17	22	28	28	28	28	90
Qingdao	0	30	50	70	70	70	70	100
Guiyang								
Shenyang	42	50	58	67	75	83	83	120
Shanghai	0	0	42	63	83	92	92	120

Note. Only the highest education points are scored, without accumulation.

TABLE 12 Point accumulation rules of technical skills

City	Primary	Middle	Senior worker	Junior title (technician)	Intermediate title (technician)	Senior title (technician)	The highest point	Non-standardized score
Beijing								
Guangzhou[a]	0	33	67	0	100	100	100	60
Guangzhou[b]	12	35	59	0	118	118	118	85
Shenzhen[d]	20	40	70	70	90	100	100	100
Shenzhen[c]	50	83	117	100	150	167	167	60
Tianjin	4	11	21	14	29	36	36	140
Nanjing	0	0	0	80	120	120	120	100
Haikou								80
Ningbo	0	0	0	28	33	39	39	90
Qingdao	30	50	50	60	60	60	60	100
Guiyang								
Shenyang	0	0	0	50	75	83	83	120
Shanghai	0	0	0	0	83	117	117	120

Note. a denotes the data coming from the introduction of "Management Approach of Guangzhou Point Accumulation System" in 2014; b represents the data coming from the promulgation of the "Service Guidance of Point Accumulation settled for Migrant Workers and Citizens without *Hukou* of the 10 Urban Districts of Guangzhou" in 2013. c refers to that the data comes from the "Interim Measure of Point Accumulation Settled for Migrant Workers in Shenzhen" in 2012; d refers to the data from the issue of the "comprehensive assessment index and scores of talents introduction in Shenzhen" in 2013.

higher points one can get. The cumulative or average personal tax up to 10 million in recent three years can exchange for 10–20 points in different cities.

In terms of bonus rules, major cities have different levels of credit for all kinds of honors at the provincial level and above. Specifically, Nanjing and Shanghai have greater rewards for applicants with honor. But Beijing, Tianjin, and Shenzhen have relative fewer bonuses.

For subtraction rules, applicants with bad credit and administrative penalties or detention records will be subject to 20 points reduction penalty or 80 points reductions if it is relatively serious. The deduction is cumulative. Those providing the false information, having transcendental behavior, participating in cults or illegal organizations or having criminal records will be punished to varying degrees.

5 | CONCLUDING REMARKS

As China's fundamental institutional arrangements, the *Hukou* registration system plays an important role in national development but creates a lot of problems related to efficiency and equity. We conducted a comprehensive survey on *Hukou* registration policies at the national, provincial, and prefecture level. The analysis focuses on changes of *Hukou* registration stringency by constructing a registration index and compares the point systems of large cities.

We find that the requirements for local urban *Hukou* qualification vary significantly among Chinese cities. For the *Hukou* granting for investment, the average amount of investment in the first-tier cities is 43.59 times of the fifth-tier cities, 14.29 times of the fourth-tier cities, 7.21 times of third-tier cities, and 3.36 times of the second-tier cities, but the gap is gradually narrowing. As for the home purchase

channel, the differences in purchase area requirements is not large in the first-, second-, third-, fourth-, and fifth-tier cities, but is rather difficult for migrants to get *Hukou* from this channel if taking the high housing prices in big cities into account. For employment, the first- and second-tier cities generally have higher requirements on education, years of employment, years of residence, and social security payment. Generally, Chinese cities with higher *Hukou* registration requirements are mainly located in the Pan-Pearl River Delta, Yangtze River Delta, and Beijing–Tianjin–Hebei region. Meanwhile, capital cities in the Midwest China and regional primate cities also set a relatively high bar for getting local urban *Hukou*.

The new point account system for *Hukou* registration in major cities shows that cities have different preferences for the age, education, skills, employment, and social security payment of workers qualified to get local *Hukou*. Although the point system seems to offer a hope for migrant workers to get local *Hukou* in a more transparent way, but how easy they can be registered is still firmly controlled by local governments. Moreover, the point system is only allowed in China's big cities.

The evolution of China's household registration system is of great value to the understanding of the motives of local government development and reform. For a long time, local governments have used *Hukou* as a tool to promote the development of urbanization or to restrict the flow of population. It reduces social mobility and leads to inefficient allocation of labor and other resources. To achieve sustainable development, China will have to deal with the economic and social problems caused by *Hukou* and fulfill the equal access to public service for urban residents.

Currently, most of the small- and medium-sized cities have removed many restrictions on *Hukou* registration. Large- and medium-sized cities are focusing on promoting the equalization of public services. On January 1, 2016, the No. 663 "Provisional Regulations on Residence Permit" of the State Council Order came into effect. Local governments revised the relevant residence permit management rules and started to provide the six categories of basic public services[6] and seven categories of convenience[7] to residence permit holders. We believe these are the right directions.

The quantitative measures developed in this paper can be used to study many topics related to labor market mobility barriers. Previous literature (Au & Henderson, 2006; Rossi-Handberg, 2013; Tombe & Zhu, 2015) has recognized the important role that *Hukou* plays in affecting China's urban development, but no research has conducted the analysis by specifically modeling the *Hukou* stringency in Chinese cities. The measure developed in this paper can be useful for a quantitative analysis on *Hukou* reform in a spatial economic framework as summarized in Redding and Desmet and Rossi-Hansberg (2013).

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ENDNOTES

[1]As the household registration system and its related social welfare, including food distribution, strictly limits the flow of population, the number of "floating population" (migrants without local Hukou registration) in China in 1982 was only 6.57 million, accounting for just 0.66% of the total population (Duan, Wang, & Wang, 2008).

[2]There are 292 cities in China's urban statistical yearbook. Our current household registration documents involve 251 cities. Among the 251 cities, some of the cities miss several types of documents and others miss policy documents for either period in our study: 2000–2013 and 2014–2016. Our later analysis focuses on four types of policy documents and compares their changes before and after 2013. For that purpose, we have complete information for only 120 cities.

[3]The city tiers have no official definition, but commonly used in the literature. The first-tier includes China's superstar cities (Gyourko, Mayer, & Sinai, 2013): Beijing, Shanghai, Guangzhou, and Shenzhen. The second-tier cities typically refer to the 15 vice-provincial cities plus Tianjin and Chongqing, and most of them are the more developed provincial capital cities. The third-tier cities are other provincial capital cities and some of the larger cities in developed provinces. The fourth and fifth tiers are other less developed small cities. The cities tiers are positively related to population size of those cities.

[4]All the results from the robustness checks are available from the authors. Missing data interpolation: the paper adopts the replacement method with similar cities to fill the missing data in investment, tax payment, or other aspects. For example, for the missing of investment amount, tax amount, title, education, and other data, adding the missing data by finding a city in the same region where the economic and social development level (specifically the level of per capita income, financial income, and the number of doctors per million, etc.) are similar, and using the investment and tax payment amount of the similar city to substitute.

[5]Unlike other cities, the residence permit system in Shanghai is used to determine the availability of public services rather than decide whether one can obtain *Hukou* status or not. But Shanghai's point accumulation rules are comparable with other cities. In addition, according to our survey in Guiyang in June 2017, the point account system has been abolished. But we still retain Guiyang for the consideration of research and comparison.

[6]Article 12 states that the people's governments at or above the county level and their relevant departments shall provide the following basic public services for the holder of the residence permit: (a) Compulsory education; (b) Basic public employment services; (c) Basic public health services and family planning services; (d) Public cultural and sports services; (e) Legal aid and other legal services; (f) Other basic public services provided by the State.

[7]Article 13 states that the holder of a residence permit shall enjoy the following facilities in the place of residence: (a) To handle entry and exit documents in accordance with the relevant provisions of the State; (b) To replace, renew identity card in accordance with the relevant provisions of the state; (c) To register motor vehicle; (d) To apply for a motor vehicle driver's license; (e) To sign up for a vocational qualification examination and apply for a professional qualification; (f) To register the fertility services and process other family planning certificate; (g) Other facilities provided by the State.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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