Semi-urbanization and evolving patterns of urbanization in China: Insights from the 2000 to 2010 national censuses

LIU Xiang^{1,2}, *CAO Guangzhong¹, LIU Tao³, LIU Hanchu⁴

1. College of Urban and Environmental Sciences, Peking University, Beijing 100871, China;

2. School of Urban Planning and Design, Peking University, Shenzhen 518055, Guangdong, China;

3. Center for Population and Development Studies, Renmin University of China, Beijing 100872, China;

4. Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China

Abstract: Based on the prefecture-level data of the 2000 and 2010 national censuses, the spatial evolution of China's semi-urbanization is analyzed in this study. The stages of urbanization are re-examined by considering semi-urbanization. Nine types of urban development are presented according to the relations between semi-urbanization and urbanization, and China's urbanization is divided into five stages, namely, high incoordination, incoordination, low coordination, coordination, and high coordination. Results show that China's semi-urbanization rate varies significantly from one area to another; its order in 2010 from the highest to the lowest value was as follows: east, middle, west, and northeast. Urbanization and semi-urbanization rates in inland cities increase much faster than those in coastal cities. In addition, semi-urbanization displays a spatial pattern similar to that of urbanization across China, with the sole exception of the northeastern region. Through a spatial autocorrelation analysis, the spatial concentration of semi-urbanization is determined to be increasing. High-value concentration areas are expanding in the coastal east, whereas low-value concentration areas are growing in the northeast. Lastly, the evolution of China's urbanization model suggests a weakening trend of coordination between urbanization and semi-urbanization over the studied decade. Semi-urbanization can be viewed as a special production of China's *hukou* system, which restricts the permanent settlement of migrants in cities. As such, China's semi-urbanization trend is expected to exhibit a reversed U-shaped pattern as urbanization and citizenization develop.

Keywords: semi-urbanization; urbanization; spatial evolution; *hukou*; census; China

1 Introduction

China experienced unprecedentedly rapid urbanization from 2000 to 2010. During this pe-

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Author: Liu Xiang (1992–), Master, specialized in urban planning and urban geography in China.

E-mail: liuxiangv@pku.edu.cn

***Corresponding author:** Cao Guangzhong (1969–), PhD and associate professor, specialized in urban geography.

E-mail: caogzh@pku.edu.cn

riod, the urbanization rate increased from 36.22% to 49.68%, with an impressive annual increase of 1.35%. However, “urbanization” in China means that millions of people move into cities without an urban *hukou* (Chan, 2014). According to the fifth (2000) and sixth (2010) Chinese censuses, the rate from agricultural *hukou* to non-agricultural *hukou* for household populations increased by 4.41% over the same period; the gap between non-agricultural and urbanization rates increased to 9.05%. Although a large number of migrant workers are currently working and living in new cities, they do not enjoy basic social welfare services, such as education, healthcare, social insurance, and public services. The *hukou* system has a negative effect on internal migration, efficiency, social identity, and inequality (Liu, 2005; Yang, 2014; Afridi *et al.*, 2015). Thus, the issue of peasant workers’ citizenization was proposed (Liu and Xu, 2007) and became an important issue in the *New-type Urbanization Plan 2014–2020* promoted by the Chinese government (Chen *et al.*, 2016). People-oriented urbanization is the direction of the deepening reform in China (RGCP/DRC, 2006; Wang *et al.*, 2015). Semi-urbanization with Chinese characteristics may be a long-term phenomenon because most of the “urban” population is considered only “semi-urban.”

Semi-urbanization is a transitional state between village and complete urbanization (Wang, 2006). The theory of detachment mosaic by Polanyi (1957) indicates that each change in the social structure undergoes two stages: “detachment” and “mosaic.” A series of economic or social problems will arise if either stage is not achieved (Polanyi, 1957). Semi-urbanization as a transitional stage of social structural change has a research value. Semi-urbanization is a ubiquitous geographical phenomenon worldwide, and it was first mentioned in metropolitan band theory by Gottman (2007). Thereafter, the theory was developed further by McGee (1991). The phenomenon was defined as *desakota* based on urban fringe, extended metropolitan region, edge city, rural–urban integration, and *desakota*. Liu Shenghe *et al.* (2004) referred to the transitional area as a “peri-urbanization region,” where mixed rural and urban land use occurs with the rapid change in social and economic structures. Afterward, the identification (Chen, 2012), features (Liu and Zhang, 2008), morphological evolution (Han and Cai, 2011), and driving force mechanism (Liu *et al.*, 2005; Zhang *et al.*, 2008) of peri-urbanization were further discussed.

Peri-urbanization is a phenomenon that refers to both geography and population. Wang (2006) first introduced the concept of semi-urban population, arguing that rural migrants play a significant role in cities. Nevertheless, they are not literally involved in the city systematically, socially, or psychologically. Rural migrants have been moving from one area to another for a long time because of a special *hukou* system in China. However, the *hukou* system is an ineffective means to restrain population flow (Zhu, 2007; Duan *et al.*, 2008). To maintain local labor, the system offers the *hukou* population considerable resources, such as education, healthcare, social security, and public services. As a result, the large status differences between *hukou* and migrant populations impeded China’s urbanization (Zhao, 1999). A wide range of objects are involved in semi-urbanization population studies, and opinions vary. Many scholars discussed peasant workers (Li, 2011), migrant population (Ding *et al.*, 2005; Liu, Qi and Cao *et al.*, 2015), floating population (Lin *et al.*, 2014; Wong *et al.*, 2015), migrant workers (Liu and Cao, 2014), and other aspects; these discussions can be viewed as an exploration of the semi-urban population. Among these aspects, migrant workers significantly affect semi-urbanization (Hao, 2012). Citizenization of rural migrant

workers affects the employment structure of the labor market (Wu and Xiao, 2014). Furthermore, the instability of migrants is the root cause of the failure to control land construction and farmland protection policies (Liu and Liu *et al.*, 2015). Migrant instability arises mainly because migrants cannot enjoy preferential policies as the *hukou* population does. Huang and Tao (2015) proposed policy suggestions from the perspective of housing for migrant workers who intend to settle down permanently. Permanent settlement is a basic foundation of the citizenization of migrant workers. Cao *et al.* (2015) found that self-employed migrants tend to settle down in cities permanently. However, existing studies rarely use the semi-urbanization rate to analyze the semi-urbanization phenomenon. He and Huang (2012) used the difference between urbanization rate and non-agricultural rate as an index to measure semi-urbanization at the provincial level. Li (2013) introduced a new means to analyze the spatial pattern of semi-urbanization and discussed the mechanism of formation. However, the calculation method requires further investigation. Semi-urbanization is also included in China's urbanization rate; thus, the actual urbanization level is overvalued. On the contrary, Zhu (2012) believed that China's urbanization is not overvalued. Rather, it is underestimated because of the presence of "pre-urban population" (Zhu, 2012). We believe that the issue of semi-urbanization cannot be resolved because of the objective existence of the *hukou* system.

Semi-urbanization is formed under the special *hukou* system with Chinese characteristics. A high semi-urbanization rate implies that a large number of the immigrant population do not have access to education, healthcare, social welfare, public services, and so on. This inequality will exert implicit pressure on urban development in the future and even reduce the stability of the urban economy as well as the society. Given that China's semi-urbanization is different from that in other countries, a single urbanization index cannot accurately ascertain which stage a city is in. In current studies, the spatial variation of the semi-urbanization population is seldom given attention; awareness of the spatial correlation pattern is rare. Urbanization is a process. Semi-urbanization may also be a stage of urbanization in the Chinese society. Therefore, semi-urbanization is not an isolate phenomenon. It should be considered a part of the process of urbanization. Two questions must be addressed. What type of relation exists between semi-urbanization and urbanization? In the development of urbanization, what characteristics does semi-urbanization exhibit at each stage? This study analyzed the spatial and temporal evolution features of China's semi-urbanization population, compared semi-urbanization with urbanization, and discussed the patterns of urbanization at each stage by considering semi-urbanization.

2 Data and methodology

2.1 Related concepts

Urbanization rate in this article refers to the proportion of the urban population to the resident population according to the Standard of National Bureau.

$$U = Pu / (Pu + Pr), \quad (1)$$

where U is the urbanization rate, Pu stands for the urban population, and Pr pertains to the rural population. Urban population includes urban *hukou* population (Phu) and urban migrant population (Psu) (i.e., semi-urban population). However, the publicly available data

from censuses do not clearly distinguish these two types of population. Similarly, the non-agricultural population includes not only the permanent population with a local non-agricultural *hukou* but also the permanent population with foreign non-agricultural *hukou*. The two concepts are also not clearly distinguished in public data. Foreign non-agricultural *hukou* holders do not belong to the local *hukou* population because their quantity is small and because of the slight differences in social public services between the two. The non-agricultural rate of the resident population will be taken as *hukou* urbanization rate (i.e., the rate of *hukou* conversions from rural to urban, *HU*) in this calculation. Thus, a slight difference exists between the true and calculated values of semi-urbanization rate (*SU*). The formula is

$$SU = U - HU \quad (2)$$

$$P_{su} = P_u - HU * (P_u + P_r) \quad (3)$$

2.2 Methodology

Spatial correlation analysis was used to analyze the spatial dependence and heterogeneity of the semi-urbanization population. Global Moran's *I* and Local Moran's *I* were selected from global and local scales to identify the regional spatial agglomeration and dispersion association.

$$GMI = \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij} (X_i - \bar{X})(X_j - \bar{X})}{S^2 \sum_{i=1}^n \sum_{j=1}^n W_{ij}} \quad (4)$$

where *n* means the number of administrative units on the prefecture level; X_i and X_j are the observed values of *X* on the space units of *i* and *j*, respectively; and W_{ij} is a spatial weight matrix constructed by adjacent standard. The value is 1 if it is spatially adjacent and 0 if not. GMI denotes the general level of agglomeration and dispersion.

2.3 Data

This empirical study utilized prefecture-level administrative areas or above as unit samples. The research period covered years 2000 and 2010. Given that a number of administrative units changed between 2000 and 2010, data from 2000 were adjusted to be consistent with those from 2010 based on the new administration units. The final sample set included 342 samples with 287 cities (prefecture level and above) and 55 autonomous prefectures, regions, and leagues. The rate of urban, *hukou*, resident, and other non-agricultural populations were obtained from *Tabulation on the 2000 Population Census of the People's Republic of China* and *Tabulation on the 2010 Population Census of the People's Republic of China*.

3 China's spatial evolution of semi-urbanization

3.1 Differences in general characteristics

The increase in China's urbanization level is mainly due to the contribution of semi-urbanization. Zonal differences are clearly evident in semi-urbanization in terms of spatial patterns. With the development of the central region, semi-urbanization has been increasing rapidly. From a national perspective (Table 1), China's urbanization rate increased

by 13.5% from 2000 to 2010, and the semi-urbanization rate increased by 9%. Semi-urbanization accounted for 67% of the increase in urbanization. From the highest value to the lowest, the pattern of semi-urbanization in 2000 was as follows: east > west > middle > northeast. After a decade of rapid growth, the central region of semi-urbanization developed rapidly, with the pattern changing to east > middle > west > northeast. The change is related to the Strategy and Policy of Prosperous Central China proposed by the government in 2004. Semi-urbanization contributed 77.5% and 70.4% to urbanization growth in eastern and central regions, respectively. These values are above the national average. The eastern region had a strong appeal to migrant populations, but it did not transform the migrant population into genuine citizens who should have *hukou* substantially. The incomplete urbanization in eastern region exhibited a long-term trend (Liu, Qi and Cao, 2015). The semi-urbanization rate was 8.7% in northeast China, which was significantly lower than that in other regions. The semi-urbanization rate was the highest in Guangdong Province in 2010, followed by that in Zhejiang Province. The semi-urbanization rates in Xinjiang and Tibet were the lowest, and the contribution of the changes in the semi-urbanization of these two provinces was extremely small. Shanghai contributed the most to urbanization growth, such that the increase in semi-urbanization far outweighed that of urbanization.

Table 1 Changes in semi-urbanization in each province from 2000 to 2010 (%)

Province	Semi-urbanization		Urbanization		Contribution of change	Province	Semi-urbanization		Urbanization		Contribution of change
	00–10	2010	00–10	2010			00–10	2010	00–10	2010	
Beijing	6.8	24.2	8.4	86.0	81.0	Guangdong	7.4	37.4	10.5	66.2	70.5
Tianjin	2.6	19.2	7.5	79.4	34.7	Guangxi	10.6	21.0	11.9	40.0	89.1
Hebei	14.9	22.7	17.6	43.9	84.7	Hainan	5.4	14.8	9.0	49.7	60.0
Shanxi	7.7	17.3	12.8	48.1	60.2	Chongqing	7.0	18.4	50.9	53.0	13.8
Inner Mongolia	9.6	17.6	12.8	55.5	75.0	Sichuan	4.8	13.5	13.1	40.2	36.6
Liaoning	2.4	11.4	7.2	62.2	33.3	Guizhou	5.8	15.0	9.8	33.8	59.2
Jilin	1.6	7.9	3.7	53.4	43.2	Yunnan	9.7	17.8	11.2	34.3	86.6
Heilongjiang	1.9	6.3	4.1	55.7	46.3	Shaanxi	9.5	19.5	13.6	45.7	69.9
Shanghai	2.2	27.4	1.0	89.3	220	Gansu	6.8	11.3	12.0	38.2	56.7
Jiangsu	13.5	26.8	18.0	60.2	75.0	Qinghai	9.8	15.2	18.6	47.2	52.7
Zhejiang	9.2	36.7	13.0	61.6	70.8	Ningxia	3.6	9.3	11.6	36.6	31.0
Anhui	9.6	18.0	16.3	43.0	58.9	Tibet	1.3	8.0	3.2	22.7	40.6
Fujian	12.9	35.0	15.1	57.1	85.4	Xinjiang	−0.7	3.6	7.2	42.4	−9.7
Jiangxi	12.1	17.1	16.1	43.8	75.2	East	10.5	29.8	13.9	59.9	75.5
Shandong	9.1	26.3	11.6	49.7	78.5	Middle	10.0	18.5	14.2	43.9	70.4
Henan	12.1	18.7	15	38.4	80.7	West	7.1	15.6	12.5	40.2	56.8
Hubei	4.9	18.7	9.2	49.7	53.3	Northeast	2.0	8.7	5.3	57.7	37.7
Hunan	12.0	19.9	15.8	43.3	76.0	China	9.0	21.2	13.5	49.7	66.7

3.2 Temporal and spatial evolution

The spatial and temporal differences in China’s urbanization and semi-urbanization can be obtained by visualizing their changes (Figure 1). From a statistical perspective, the spatial pattern of China’s semi-urbanization and urbanization presented a high degree of consistency between 2000 and 2010. Semi-urbanization appeared to have strengthened the spatial pattern of urbanization except in the northeast. Many cities in the northeast exhibited relatively high urbanization and relatively low semi-urbanization. In 2000, semi-urbanization and urbanization had many random high values distributed in the eastern coastal areas. After

Figure 1 Spatial pattern of China's urbanization and semi-urbanization
Sources: National Censuses 2000 and 2010

a decade, continuous high values of semi-urbanization were observed in this region. Beijing–Tianjin–Tangshan, Pearl River Delta, and Yangtze River Delta regions had the highest semi-urbanization rate, followed by the southwest region of Inner Mongolia, whose industrial and mining establishments led to a boom of the local economy, which increased employment and attracted a large number of migrant workers. The urbanization rate therefore

increased substantially. Several areas in Northeast Heilongjiang and west Xinjiang had the lowest urbanization rate. In central-western China, the high value of semi-urbanization and urbanization presented “fragmentation.”

From a dynamic perspective, semi-urbanization and urbanization in space increased synchronously and showed a dramatic increase in the border between the eastern and central regions. Urbanization and semi-urbanization rates increased from the coastal areas toward the inland. In many provincial borders (e.g., Inner Mongolia/Shaanxi, Hebei/Shandong, and Hunan/Jiangxi), the increase in urbanization and semi-urbanization was high-value aggregated, indicating that the power of the market was more significant than that of the administration.

The contribution of semi-urbanization to urbanization was also calculated (Figure 2). After 10 years of development, China’s semi-urbanization contribution rate increased rapidly. In 2000, the semi-urbanization contribution rate of 35 cities reached 50% and even above. The number of cities increased to 93 in 2010. However, the semi-urbanization contribution rate of northeast China and northwest Xinjiang declined. As a result, the contribution rate increased nationwide but decreased in certain areas. In terms of spatial features, the contribution rate exhibited a decreasing trend from the southeast coast to the northeast and northwest ones.

Figure 2 Spatial pattern of China’s semi-urbanization contribution
Sources: National Censuses 2000 and 2010

3.3 Spatial characteristics

Visualization can directly reveal the spatial features of semi-urbanization rather than the spatial correlation characteristics. This study used each city, district, league, and autonomous prefecture as the basic spatial unit and calculated Global Moran’s I of 2000 and 2010 with the Geoda software. Moran’s I in 2000 and 2010 were 0.242 and 0.372, respectively, which are significant at the level of 0.001. China’s semi-urbanization exhibited positive spatial autocorrelation with low agglomeration, the level of which, however, increased with time. Local spatial autocorrelation was adopted to obtain LISA analysis results of the prefecture-level units (Figure 3). In 2000, high-high agglomeration cities were mainly distributed

in the Yangtze River Delta, Pearl River Delta, and several southeast coastal areas. Low–low agglomeration cities were mostly in the southwest and northeast. Low–high agglomeration cities were located in southeast China close to the high–high agglomeration cities. High–low agglomeration cities displayed a scattered distribution. From 2000 to 2010, high–high agglomeration extended to the north, with cities of the same type increasing from 62 to 101. Cities with positive correlations increased, and agglomeration was enhanced. Low–low agglomeration cities increased in the west and the northeast, and the number increased from 86 to 91 overall. The agglomeration of the urbanization level was low in northeastern provinces because of historical reasons (Song and Chen, 2005), which include long-term over-exploitation that resulted in depletion of resources, high dependency of industries on the macro-control of the government rather than the market itself, and the difficult adjustment of the mechanism of the historical industrial area to the current situation. As a result, urban development declined (Gan *et al.*, 2015). Low–low agglomeration existed in the southwest and Qinghai–Tibet regions and was restrained by economic and environmental factors, such as lack of investment and single industrial structure (Liu and Yang, 2012).

Comprehensive analysis of the urbanization and semi-urbanization spatial correlation

Figure 3 Spatial autocorrelation of China's semi-urbanization
Sources: National Censuses 2000 and 2010

patterns indicates that from 2000 to 2010, the semi-urbanization level exhibited agglomeration. By contrast, urbanization manifested dispersion, and its Moran's I decreased from 2.185 to 0.175. From a macro point of view, no synchronization existed between the two. Thus, further discussion of the spatial patterns is necessary. By analyzing the LISA diagram of urbanization, we observed the apparent spatial transference of high-high agglomeration areas, implying that Moran's I cannot be evaluated by size. During 2000 to 2010, the number of high-high agglomeration cities decreased in the northeast but increased along the south-east coast in terms of urbanization. In terms of semi-urbanization, the number of low-low agglomeration cities increased in the northeast, and the number of high-high agglomeration cities increased in the east coast. Low-low agglomeration cities decreased in the southwest with respect to both urbanization and semi-urbanization. Although semi-urbanization and urbanization displayed opposite characteristics of agglomeration and dispersion with Global Moran's I , the variation was consistent in each specific area. Urbanization exhibited dispersion because the agglomeration of semi-urbanization reversed the overall spatial agglomeration. Semi-urbanization reconstructed the spatial correlation pattern of urbanization. This finding also demonstrates that Global Moran's I can only indicate overall clustering. However, for specific cases, local spatial autocorrelation must be scrutinized and discussed further.

4 Reconceptualizing the evolving patterns of urbanization in China

Analyzing the spatial pattern of semi-urbanization from the perspective of evolution and relevance improves the understanding of urbanization. Urbanization rate alone fails to properly indicate at which stage of urbanization Chinese cities are in. Meanwhile, the changes in urbanization can be observed more closely based on semi-urbanization. The first step in identifying the relationship between urbanization and semi-urbanization is to explore their correlation.

4.1 Exploration of the correlation between urbanization and semi-urbanization

The correlation between semi-urbanization and urbanization in 2000 and 2010 was 0.586 and 0.440, respectively, at a confidence level of 0.01. Despite the decrease, the correlation generally remained strong. A significant positive correlation exists between semi-urbanization and urbanization in the scattering plot (Figure 4). The discrete point in 2000 was Shenzhen (Guangdong). The five discrete points in 2010 were Dongguan (Guangdong), Zhongshan (Guangdong), Foshan (Guangdong), Shenzhen and Xiamen (Fujian). If the discrete points are excluded, the diagram showing the relationship of urbanization and semi-urbanization will display an inverted U-shaped pattern. The correlation coefficient of the growth of semi-urbanization and urbanization is 0.726, which is significant at a confidence level of 0.01. This value indicates a strong correlation. In several cities, such as Lianyungang (Jiangsu) and Wuhu (Anhui), the increase in the semi-urbanization rate was relatively low, whereas the increase in the urbanization rate was relatively high. The increment, however, was small. Semi-urbanization significantly affected the evolvement of China's urbanization and concealed genuine urbanization at the same time. Therefore, the types and stages of urbanization should be further discussed by considering semi-urbanization.

Figure 4 Correlation between China’s urbanization and semi-urbanization from 2000 to 2010

4.2 Classification of cities and staged model

First, urbanization was divided into different types. Cities whose urbanization rate was less than 30% were defined as having “low-level” urbanization. Urbanization rate of 30% to 70% was viewed as “middle level,” and a rate of 70% or above was regarded as “high level.” According to statistics, the semi-urbanization rate of 342 cities in 2000 and 2010 showed an approximately normal distribution concentrating around the mean value. These “high,” “middle,” and “low” levels of semi-urbanization are relative concepts. To comprehensively determine the degree of semi-urbanization, the semi-urbanization rates of cities in both 2000 and 2010 were obtained, mean $\pm$ SD was calculated, and the results were rounded off to whole numbers, by which the scale of semi-urbanization rate was divided. A semi-urbanization rate of a city that is less than 5% was defined as “low level,” 5% to 25% was defined as “middle level,” and 25% or above was considered “high level.” By combining urbanization and semi-urbanization, we divided Chinese cities into nine different types (Figure 5, left). HL stands for high–low, that is, “high level of urbanization—low level of semi-urbanization,” HM means high–middle, that is, “high level of urbanization—middle level of semi-urbanization,” and so on. The arrows indicate a feasible direction of the city’s development in the future. The development of urbanization is a natural process, and transformation is from low to high. Given that semi-urban populations exhibit strong mobility, high, middle, and low levels of urbanization are interchangeable.

Semi-urbanization is an important dimension that affects urbanization coordination. With regard to cities on the same development stage, a low semi-urbanization rate implies that semi-urban populations enjoy equal rights as citizens and that the coordination is high. Thus, the ideal state for urban development, namely, highly coordinated urbanization, is to achieve a high degree of urbanization and a low degree of semi-urbanization. On this basis, by re-

volving Figure 5 (left) by 45° clockwise, we can obtain the five stages of urban development, namely, high incoordination, incoordination, low coordination, coordination, and high coordination. For the different types of cities on the same stage of development, we utilized the urbanization rate as the main criterion for measurement and obtained a sequence of nine types of cities (Figure 5, right).

Figure 5 Types (left) and stages (right) of urbanization based on semi-urbanization

Theoretically, if semi-urbanization and citizenization rates exhibit a dynamic balanced growth, a city would develop from the bottom to the top (Figure 5, right), that is, from the direction of high incoordination to high coordination. To explore the actual situation of how different types of cities evolved at different stages, 342 cities in China were used as samples to conduct an empirical analysis.

4.3 Evolving patterns of urbanization in China

According to the statistical data of China’s 342 cities in 2000 and 2010, an evolution matrix of the nine types of cities was established (Table 2). The longitudinal and horizontal columns include all cities of different types in 2000 and 2010, respectively. Theoretically, 81 evolution types should exist; however, in reality, only 26 types have been reported.

Table 2 Matrix of the nine types of cities on urbanization evolution from 2000 to 2010

2000	2010									Total
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	
Type 1	—	—	—	—	—	—	—	—	—	0
Type 2	—	17	10	—	68	—	—	—	—	95
Type 3	—	—	12	—	2	2	—	—	—	16
Type 4	—	26	1	6	24	—	2	—	—	59
Type 5	—	1	33	—	80	5	5	7	—	131
Type 6	—	—	—	—	—	6	—	2	—	8
Type 7	—	—	—	—	7	—	11	1	—	19
Type 8	—	—	—	—	—	2	—	7	4	13
Type 9	—	—	—	—	—	—	—	—	1	1
Total	0	44	56	6	181	15	18	17	5	342

To obtain a clear evolution matrix path, we connected the data with Figure 5 (Figure 6). From a statistical perspective, the number of Type 5 is the highest, followed by Types 2, 3, and 7. The static state does not signify that urbanization and semi-urbanization rates have not changed. A small change range does not necessarily mean that city type change does not occur. Type 5 (i.e., MM urbanization) converts most closely with other types of cities. The numbers of Type 9 were 1 and 5 in 2000 and 2010, respectively, indicating that a few cities were in high coordination. From a dynamic perspective, the type transition exhibits a certain degree of complexity. In line with an earlier hypothesis, the tendency shows a one-way increase in the direction of urbanization and presents a bidirectional conversion in the direction of semi-urbanization. Particularly, the urbanization rate of the Shannan Prefecture (Tibet) declined, which is related to geographical conditions and well-developed agriculture and pasture. Cities in the path of “2→5” are the highest in number, which indicates that a low-urbanization city with middle semi-urbanization is most likely to shift to a high stage. Thirty-four cities are in the paths of “4→5” and “2→3.” Although their stages have not changed, their urbanization and semi-urbanization rates have increased considerably. Fifty-nine cities are in the paths of “4→2” and “5→3.” The coordination of these cities declined. In this decade, none of the cities have transformed directly from Type 7 to Type 9, suggesting that a middle-urbanized city can hardly ascent directly from middle urbanization to high urbanization if its semi-urbanization rate has not increased significantly. The small number of cities that transformed from Type 4 to Type 7 can also verify this conclusion.

Figure 6 Evolution (left) and development models (right) of the nine types of cities
Note: The arrows indicate the evolution direction of the types of cities. The thickness corresponds to the number of cities in the evolution direction. The size of the circle indicates that the evolution type of change in the number of cities did not occur.

After simplifying the evolution path of the 342 cities, a parallelogram structure is left on the graph. By rotating Figure 6 to the left by 45° counter-clockwise and assuming that the original style of the city is L-L urbanization (Type 4), we found that the trend of changes in China’s cities is “4→3” (Figure 6, right) at the present stage, which indicates that urbanization and semi-urbanization levels have increased simultaneously. Although many cities transformed from Type 2 to Type 5, semi-urbanization and urbanization have a strong correlation. The semi-urbanization of the two city types has also improved considerably, although

stage variation has not appeared. In fact, many cities have transformed to Type 5, and most Type 5 cities have transformed to Type 3. From 2000 to 2010, Suqian City from Jiangsu Province directly transformed from Type 4 to Type 3, which also verifies the trend of “4→3.” From the stage perspective, the current transformation path of 342 cities is mainly from “low coordination” to “incoordination.” When cities are at the stage of Type 3 or Type 6, to prevent the semi-urbanization rate from becoming extremely high and thus affecting the stability of the society, the government should deepen the reform of the *hukou* system by guiding and promoting the conversion of citizenization of peasant workers. Then, the cities will turn to a coordinating direction, namely, “3→9.” The overall trend of the transformation of city type will be “4→3→9” and possibly “4→6→9.” The direction of arrows simply represents a trend of directivity.

5 Discussion and conclusions

5.1 Discussion

Urbanization level is an important symbol of national economic development and industrialization. Urbanization is a natural process, and semi-urbanization is a stage of urbanization in China (Figure 7). After the foundation of the People's Republic of China, China's urbanization experienced tortuous development types, including short-term development, fluctuations, and stagnation (Xu *et al.*, 2009). In the First Five-year Plan period, the northeast old industrial base was basically completed, and the rapid development of state-owned enterprises and heavy industries led to a rapid increase in local urbanization. From reform and opening up to the mid-1990s, the household contract responsibility system liberated the rural surplus labor, leading to the rapid development of township enterprises (Zhou and Cao, 1999). Meanwhile, relaxation of the *hukou* system promoted the flow of rural surplus labor into cities (Wang, 2013), but it was only a transfer type of “departing from farming without leaving the native land.” Within the limits of the *hukou* system, the phenomenon of semi-urbanization appeared in several regions (Wu, 1994). Since then, the coastal opening-up policy attracted a large number of foreign investment enterprises, and many economic development zones were generally built in cities and small towns. On the one hand, export-oriented manufacturing and labor-intensive enterprises created numerous jobs. On the other hand, the level of mechanization in rural areas was promoted. As a result, massive rural surplus labor was released again. Under the joint power of rural “push” and cities’ “pull,” China demonstrated a large-scale population migration. The level of urbanization improved rapidly in the east coastal areas. In the beginning of the 21st century, China became a member of the World Trade Organization, and the process of globalization continued to accelerate. To find cheap labor, a large number of western foreign-funded enterprises moved to China, thus engendering the third worldwide industrial transfer phenomenon (Gu *et al.*, 2015). The implementation of strategies, including Northeast Revitalization, Middle Rise, and the Western Development, increased capital investments in inland regions and agricultural productivity and thus promoted the further expansion of industrialization and the transfer of surplus labor, which accelerated China's urbanization. To pursue rapid urban development, China did not completely break down the barriers of the *hukou* system. The level of urbanization developed rapidly, and semi-urbanization also increased fast. As a result, the level of

urbanization developed from low coordination to incoordination.

With the rapid development of urbanization, semi-urbanization will reach a critical point. At this point, the semi-urbanization population will be the highest. Moreover, the urban–rural income inequality will be the largest during the acceleration stage of China’s urbanization (Wan, 2013). Social instability will also be the strongest because semi-urbanization populations cannot enjoy equal treatment deserved by all citizens. Therefore, reducing development costs through the *hukou* system model is unsustainable. In addition, rural surplus labor is not unlimited. Research data from the *Development Research Center of the State Council* show that the scale of China’s migrant labor force decreased constantly after 2010 (Han *et al.*, 2009). The national *New-type Urbanization Plan* (2014 to 2020) suggests human-oriented urbanization, which aims to achieve basic equality of compulsory education, employment, basic endowment, and so on for the semi-urbanization population. Its essence is to guide and promote the transfer of “non-agricultural peasant workers” to “citizenization of peasant workers.” Thus, semi-urbanization will begin to decline if it reaches the critical point, and cities would develop from “incoordination” to “coordination.”

Figure 7 Reverse U-shaped pattern of China’s semi-urbanization

In summary, the semi-urbanization population will show a development trend of “inverted U-shaped” pattern. The overall process and sub-process will not be fully coordinated during urbanization (Cao *et al.*, 2011). Coordination will even decrease in the overall process of development (Liu *et al.*, 2010). The development of semi-urbanization as a subsystem of urbanization will also experience a process of “low incoordination → coordination → high coordination.” Thus, semi-urbanization will be a phased phenomenon of China’s rapid urbanization, and urbanization will be a torturous development process.

5.2 Conclusions

Based on the prefecture-level data of the fifth and sixth censuses, this study analyzed the spatial patterns and evolution path of China’s urbanization, with emphasis on the discussion of urbanization from the perspective of semi-urbanization and reconceptualization of the stage characteristics from the relationship between semi-urbanization and urbanization. The main conclusions are as follows.

(1) China’s semi-urbanization has obvious zonal differences. A spatial pattern of “east > middle > west > northeast” was formed in 2010. Except for the northeast, the spatial pattern

of and changes in semi-urbanization and urbanization show a high degree of similarity and synchronization. The increase in China's urbanization is mainly due to the contribution of semi-urbanization, and the contribution degree decreases from east, south, southwest, to the inland. The change in urbanization and semi-urbanization has exhibited a trend of "inland." The level of urbanization in the northeast is generally high, but the rate of semi-urbanization is low.

(2) In 2000 to 2010, the spatial agglomeration of semi-urbanization improved. The scope of HH agglomeration expanded in the eastern coastal areas and extended to the north. LL agglomeration expanded to the northeast and southwest regions. The overall level of the agglomeration of urbanization decreased, but the range of HH agglomeration narrowed in the northeast and expanded to the eastern coastal areas. Essentially, semi-urbanization affected the spatial correlation pattern of urbanization.

(3) Semi-urbanization and urbanization have a strong correlation, and semi-urbanization is an important dimension to evaluate the coordination of urbanization. To address this issue, the types of Chinese cities were divided into nine types and further divided into five stages, including high incoordination, incoordination, low coordination, coordination, and high coordination. L-H type urbanization did not exist in 2000 and 2010. After analyzing the transformation path of the types of Chinese cities, we conclude that the main development path of Chinese cities was from "low coordination" to "incoordination" in 2000 to 2010.

(4) The development path of semi-urbanization has an inverted U-shaped pattern. Semi-urbanization can economize the development costs of a city. Nevertheless, the *hukou* system can also generate social inequality attached with the interests of education, health-care, social security, public services, and so on. Therefore, the level of semi-urbanization should be limited to some extent. When rural surplus labor stops increasing and the economic development of the city reaches a high level, several strategies should be adopted to guide and promote migrant workers to become citizens. Cities would transform to the stage of "high urbanization–low semi-urbanization" and would ultimately achieve complete urbanization in the future.

References

- Afridi F, Li S X, Ren Y, 2015. Social identity and inequality: The impact of China's hukou system. *Journal of Public Economics*, 123: 17–29.
- Cao G Z, Bian X, Liu T, 2011. Comprehensive evaluation of the urbanization level in Yangtze River Delta region: An index framework based on the population, economic structure and landuse. *Geographical Research*, 30(12): 2139–2149. (in Chinese)
- Cao G Z, Li M, Ma Y *et al.*, 2015. Self-employment and intention of permanent urban settlement: Evidence from a survey of migrants in China's four major urbanising areas. *Urban Studies*, 52(4): 639–664.
- Chan K W, 2014. China's urbanization 2020: A new blueprint and direction. *Eurasian Geography & Economics*, 55(1): 1–9.
- Chen B B, 2012. Review on identification method and driving mechanism of peri-urban area. *Progress in Geography*, 31(2): 210–220. (in Chinese)
- Chen M X, Liu W D, Lu D D, 2016. Challenges and the way forward in China's new-type urbanization. *Land Use Policy*, 55: 334–339.
- Ding J H, Liu Z Y, Cheng D M *et al.*, 2005. Areal differentiation of inter-provincial migration in China and characteristics of the flow field. *Acta Geographica Sinica*, 60(1): 106–114. (in Chinese)

- Duan C R, Wang W L, Wang T Y, 2008. Fifty years of the household registration system. *Population Research*, 32(1): 43–50. (in Chinese)
- Gan J, Guo F Y, Chen C *et al.*, 2015. The spatio-temporal evolution characteristics of urbanization spatial differentiation in Northeast China. *Scientia Geographica Sinica*, 35(5): 565–574. (in Chinese)
- Gottmann J, 2007. Megalopolis or the urbanization of the northeastern seaboard. *Urban Planning International*, 33(3): 189–200.
- Gu C L, Kesteloot C, Cook I G, 2015. Theorising Chinese urbanisation: A multi-layered perspective. *Urban Studies*, 52(14): 2564–2580.
- Han F, Cai J M, 2011. The evolution and reconstruction of peri-urban rural habitat in China. *Geographical Research*, 30(7): 1271–1284. (in Chinese)
- Han J, Wang Z H, Cui C Y, 2009. General report on Chinese migrant workers status and their development trends. *Nature*, 110(5): 113–122. (in Chinese)
- Hao L X, 2012. Cumulative causation of rural migration and initial peri-urbanization in China. *Chin. Sociol. Rev.*, 44(3): 6–33.
- He W, Huang X J, 2012. Incomplete urbanization: A research on China's urbanization. *Urban Planning Forum*, (2): 24–32. (in Chinese)
- Huang Y Q, Tao R, 2015. Housing migrants in Chinese cities: Current status and policy design. *Environment & Planning C Government & Policy*, 33(3): 640–660.
- Li A M, 2013. Peri-urbanization in China. *Population Research*, 37(4): 80–91. (in Chinese)
- Li G, 2011. The adaptability of migrant workers and the formation of semi-urbanization in China. *Northeast Population*, 32(6): 31–35. (in Chinese)
- Lin L Y, Zhu Y, Liang P F, Xiao B Y, 2014. The spatial patterns of housing conditions of the floating population in China based on the sixth census data. *Geographical Research*, 33(5): 887–898. (in Chinese)
- Liu C G, Xu J L, 2007. Second generation peasant workers and their citizenization. *China Population Resources & Environment*, 17(1): 6–12.
- Liu R, Cao G Z, 2014. Population size, distribution and factors impacting on citizenization of Chinese migrant workers. *Progress in Geography*, 33(6): 748–755. (in Chinese)
- Liu S H, Chen T, Cai J M, 2004. Peri-urbanization in China and its major research issues. *Acta Geographica Sinica*, 59 (Suppl. 1): 101–108. (in Chinese)
- Liu S H, Ye S Z, Du H L, *et al.*, 2005. A probe into the impetus and mechanisms for the formation of quasi-urbanization area and its development prospect a sample study on Shaoxing County, Zhejiang Province. *Geographical Research*, 24(4): 601–610. (in Chinese)
- Liu S H, Zhang Q, 2008. The change of spatial distribution of peri-urbanization areas in Hangzhou Municipality. *Geographical Research*, 27(5): 982–992. (in Chinese)
- Liu T, Cao G Z, Bian X, 2010. Evaluating the coordination between urbanization and industrialization and socio-economic development. *Human Geography*, 25(6): 47–52. (in Chinese)
- Liu T, Liu H, Qi Y J, 2015. Construction land expansion and cultivated land protection in urbanizing China: Insights from national land surveys, 1996–2006. *Habitat International*, 46: 13–22.
- Liu T, Qi Y J, Cao G Z, 2015. China's floating population in the 21st century: Uneven landscape, influencing factors, and effects on urbanization. *Acta Geographica Sinica*, 70(4): 567–581. (in Chinese)
- Liu T, Qi Y J, Cao G Z *et al.*, 2015. Spatial patterns, driving forces, and urbanization effects of China's internal migration: County-level analysis based on the 2000 and 2010 censuses. *Journal of Geographical Sciences*, 25(2): 236–256.
- Liu Y S, Yang R, 2012. The spatial characteristics and formation mechanism of the county urbanization in China. *Acta Geographica Sinica*, 67(8): 1011–1020. (in Chinese)
- Liu Z Q, 2005. Institution and inequality: The hukou system in China. *Journal of Comparative Economics*, 33(1): 133–157.
- Mcgee T, 1991. The Emergence of Desakota Regions in Asia: Expanding a Hypothesis. Honolulu: University of Hawaii Press.

- Polanyi K, 1957. *The Great Transformation: The Political and Economic Origins of Our Time*. Boston: Beacon Press.
- Research Group of China Population and Development Research Center (RGCP/DRC), 2012. China's urbanization strategy. *Population Research*, 36(3): 3–13. (in Chinese)
- Song Y X, Chen Q Y, 2005. Development of cities of Northeast China and its historic role in the 20th century. *Geographical Research*, 24(1): 89–97. (in Chinese)
- Wan G H, 2013. The urbanization-inequality nexus: Method and application to China. *Economic Research Journal*, (5): 73–86. (in Chinese)
- Wang C G, 2006. A study of floating rural people's "semi-urbanization". *Sociological Studies*, 5(7): 107–122. (in Chinese)
- Wang X L, 2013. *The quality of China's urbanization: Based on citizenization* [D]. Tianjin: Nankai University. (in Chinese)
- Wang X R, Hui E C, Choguill C *et al.*, 2015. The new urbanization policy in China: Which way forward? *Habitat International*, 47: 279–284.
- Wong T C, Han S S, Zhang H, 2015. *Population mobility. Urban Planning and Management in China*. New York: Springer.
- Wu H X, 1994. Rural to urban migration in the People's Republic of China. *The China Quarterly*, 139: 669–698.
- Wu Q, Xiao H, 2014. Dynamic CGE model and simulation analysis on the impact of citizenization of rural migrant workers on the labor and capital markets in China. *Discrete Dynamics in Nature and Society*, 1–8.
- Xu X Q, Zhou Y X, Ning Y M *et al.*, 2009. *Urban Geography*. Beijing: Higher Education Press, 104–106. (in Chinese)
- Yang S, 2014. What should economists know about the current Chinese hukou system? *China Economic Review*, 29: 200–212.
- Zhang M, Zhen F, Zhang X M, 2008. Characteristics and mechanisms of the peri-urbanization in China's less developed coastal areas: A case study of Putian, Fujian Province. *Geographical Research*, 27(4): 927–937. (in Chinese)
- Zhao Y H, 1999. Leaving the countryside: Rural-to-urban migration decisions in China. *American Economic Review*, 89(2): 281–286.
- Zhou Y X, Cao G Z, 1999. The urbanization process in China in the past 20 years. *City Planning Review*, 23(12): 8–13. (in Chinese)
- Zhu Y, 2007. China's floating population and their settlement intention in the cities: Beyond the hukou reform. *Habitat International*, 31(1): 65–76.
- Zhu Y, 2012. Is the figure of 51.27 percent an over-estimation of China's urbanization rate? Some thoughts in the international context. *Population Research*, (2): 31–36. (in Chinese)