

# Evolutionary Pattern and Effect of Administrative Division Adjustment During Urbanization of China: Empirical Analysis on Multiple Scales

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**Abstract:** The adjustment of administrative divisions is one of the important factors guiding China's urbanization, which has profound economic and social effects for regional development. In this paper, we comprehensively describe the process of the adjustment of administrative divisions at provincial and municipal levels in China and summarize the effects on the basic structure and patterns of the spatial development. We quantitatively assess the effects on fields such as urbanization and social economy through the use of multidimensional scaling. The results show that: 1) Upgrading county to municipality (or city-governed district) is the main way of adjusting the administrative divisions. It is also an important factor in the spatial differentiation of interprovincial urbanization. China's population urbanization can be divided into four patterns including interprovincial migration, provincial migration, natural growth, and growth caused by the adjustment of administrative divisions, which is also the main reason for the increased Chinese urbanization rate at the provincial level. 2) Taking the city of Beijing as an example, we generalize five adjustment patterns made to administrative divisions: the set-up of sub-districts, the set-up of regional offices, the upgrading of townships to sub-districts, the upgrading of townships to towns, and the set-up of towns and the addition of new regional offices. We summarize the municipal urban spatial structure, including the sub-district office area in the central urban area, the regional office area in the new urban area, the mixed area of villages, towns, and sub-district offices in the suburb area, and the township area in the outer suburb area. 3) The adjustment of administrative divisions triggers a significant circulative accumulation effect, resulting in the spatial locking of population and industrial agglomeration. It affects the evolution of the urban spatial form and plays an important role in shaping the urban spatial structure to move to the characteristic of multicenter. In general, the adjustment of administrative divisions was an important factor affecting the inflated statistical level of urbanization and also an important driving force for the evolution of Chinese urban spatial organization structure.

**Keywords:** administrative division adjustment; evolutionary structure; effect evaluation; multidimensional scaling; urbanization; China

**Citation:** YU Hu, DENG Yu, XU Shan, 2018. Evolutionary Pattern and Effect of Administrative Divisions Adjustment During Urbanization of China: Empirical Analysis on Multiple Scales. *Chinese Geographical Science*, 28(5): 758–772. <https://doi.org/10.1007/s11769-018-0990-2>

## 1 Introduction

The set-up of the administrative division was the institutional guarantee for the political superstructure to implement national and regional security management (Liu et al., 2007). The political superstructure achieved the

regional division and dynamic management by dividing the regions and ruling them. The historical set-up of administrative divisions was based on national unity and political stability, the modern adjustment of administrative divisions mainly served the practical needs of rapid economic and social development, as well as promoting

Received date: 2018-03-06 ; accepted date: 2018-06-04

Foundation item: Under the auspices of National Natural Science Foundation of China (No. 41701164, 71433008), Programme of Excellent Young Scientists of the Institute of Geographic Science and Natural Resources Research, Chinese Academy of Science

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urbanization (Zhou, 1998; Zhang et al., 2013; Yang et al., 2017). The adjustment of administrative divisions had the objective of promoting social and economic development in the different urban development stages. With the increasing urban economic strength, the restriction of urban administrative zoning to regional economic development was becoming more and more prominent. The urban function was expanding outward because of the expansion of the urban scale, the regionalization of cities, and suburbanization. To address these issues, the adjustment of administrative divisions was needed to optimize the urban management and improve managerial efficiency. For instance, since 1960s, developed countries such as Britain, Germany, and France have adopted methods such as the recombination and merging of administrative zones and boundary adjustment to optimize city management under rapid urbanization (Wang and Chen, 2011). Differing from the unified and narrow administrative division of foreign countries, China implemented a management pattern of wide-area administrative zones and urban-rural divisions. The adjustment of administrative divisions and urban-rural planning became two important means for China to deal with the relationships between the central urban areas and the neighboring counties and cities under urban expansion. Upgrading county to municipality and changing county to urban district were important patterns of China's administrative division adjustment and urbanization. It was the system needed to study evolutionary structure and influencing effect of administrative division in Chinese urbanization to improve managerial efficiency of urban administrative divisions and reconstruct the intergovernmental relations in cities.

The pattern of adjustment made to administrative divisions had an important impact on regional urban systems in terms of the layout, public service facilities, population flow, and industrial location decisions (Fan, 2011; Zhao, 2012). A correct understanding of the response pattern and the mechanism of the adjustment made to administrative divisions in China under the scenario of rapid urbanization could provide government at all levels with the theoretical guidance and scientific basis for correctly understanding the relationship between urbanization and administrative divisions. The previous researches into administrative divisions have mainly investigated city patterns (Wheeler, 2002; Liu, 2003; Pu, 2006a; Zhu, 2015), governance of intergov-

ernmental relations (Vojnovic, 2000; Zhang et al, 2002; Luo and Shen, 2006; Luo, 2007), and the spatial structure of urban administrative divisions (Yang and Wang, 2011). Study of the effect of the adjustment of administrative divisions has mainly been carried out from indirect aspects such as economic growth (Qian and Weingast, 1997; Wang and Nie, 2010), housing prices (Shi and Xu, 2011), the types and patterns of adjustment (Wei et al., 2009; Qu, 2012; Yang et al., 2013; Si, 2014; Zhu et al., 2015), changes of urban population (Ma, 1990; Cai, 2010; Wang, 2011), and the contributing factors (Fan, 2004; Lin and Ke, 2008; Liu and Jin, 2014; Shi, 2014). The above studies were mainly based on the perspective of administrative management, and described the background and development of the administrative division adjustment from the macro trends. Most of the researches on adjustment effect were qualitative interpretation, lack of quantitative research and cognition about population statistics affect as a whole. And the analysis of real estate price and economic growth was fragmented and lacked basic geographical understanding. In addition, the adjustment of administrative divisions, through the re-division and combination of urban and rural areas and population structure, affected the organizational structure and factor inputs of both production and life (Pu, 2006b; Fan, 2013). Positive adjustment of administrative divisions (upgrading) could inject administrative resources for regional development and improve the supply of public goods and the capacity for social governance. It attracted the inflow and agglomeration of development factors, including personnel, technology, and industry, having different effects on the different levels of administrative regions. In terms of the regional level, the adjustment of administrative divisions could optimize the regional urban system, guide the population migration and industrial agglomeration direction, and strengthen inter-city economic and social contact through the revoking, merging, and upgrading of administrative divisions (Liu and Wang, 2000; Pu, 2006b). As for the city level, the recombination or upgrading of townships and sub-districts led to the optimization and reconstruction of the urban spatial structure, industrial layout, and the allocation of public infrastructure (Collin et al., 2002; Zhang et al., 2002; Luo, 2007; Feiock, 2009). At the level of township and sub-district, the perfection of administrative functions and management systems promoted the evolu-

tion of the regional function (Luo, 2005; Wang et al., 2006; Luo et al., 2010; Liu and Wong, 2018). In addition, the effective functioning of multiscale interaction and the synergistic characteristic of the adjustment of administrative divisions could help to promote the formation of sustainable development patterns for regions and cities.

The above studies have paid more attention to the description of individual cases and the patterns of adjustment made to administrative divisions. However, few studies have systematically reviewed the evolutionary structure and patterns of administrative divisions in Chinese urbanization. For this reason, the paper, based on data deduction and regression analysis, systematically analyzed the evolution mode of China's administrative division adjustment, quantitatively analyzed the impact of administrative adjustment on population urbanization and the evolution of spatial structure of typical cities, we hope this study can help understand the role of the adjustment of administrative divisions in the process of Chinese urbanization process, and provide scientific basis for the optimization of urban systems and spatial organization structures.

## 2 Research Methods and Data Sources

### 2.1 Method of predicting urban population composition

The composition of the urban population includes natural urban population growth, newly increased rural migration, immigration, and the newly increased urban population caused by the adjustment of administrative divisions, as shown in Formula (1). The newly increased urban population between 2000 and 2010 can be obtained by subtracting the urban population of 2000 from that of 2010, as shown in Formula (2). The natural growth of urban population in the province was obtained by multiplying the total urban population of 2000 by the decadal growth rate, as shown in Formula (3). The population from newly increased rural migration and immigration can be obtained directly and indirectly from the sixth national census, respectively. Therefore, the newly increased urban population caused by the adjustment made to administrative divisions can be calculated as follows:

$$\Delta UP = UP_N + UP_{intra} + UP_{inter} + UP_{aa} \quad (1)$$

$$\Delta UP = UP_{2010} - UP_{2000} \quad (2)$$

$$UP_N = UP_{2000} \times R_{n, 2000s} \quad (3)$$

where  $UP$  indicates the total urban population;  $\Delta UP$  indicates the urban population change between 2000 and 2010;  $UP_N$  indicates the natural urban population growth;  $UP_{intra}$  indicates the population from newly increased rural migration;  $UP_{inter}$  indicates the population from external immigration;  $UP_{aa}$  indicates the newly increased urban population caused by the adjustment of administrative divisions; and  $R_{n, 2000s}$  indicates the average decadal population growth rate.

### 2.2 Data sources

The population movement data were obtained from the fifth and sixth national censuses (The census bureau of the state council et al, 2001&2012) in 2000 and 2010. It should be noted that this study independently considered and predicted the natural population growth and spatial mobility; that is, the study left out the impact of the flowing population on the province's fertility. The reason for this is that, according to the sixth national census, China's family migration trend was obvious, i.e., the fertility rate of the flowing population was lower than that of the resident population, and more and more people were coming back to their hometown to raise families. In addition, birth control statistics for a flowing population were difficult to obtain. The census or sample survey of the fertility rate of the resident population was an important standard to determine or modify the population fertility rate.

Being a case study at the municipal level, the city of Beijing involved six kinds of administrative divisions: municipal district, county, sub-district, town, township, and regional office, which was the ideal case area of this study. The indexes of type, quantity, and social economy of the administrative zones were obtained according to the Beijing Statistical Yearbook (2001–2011) (Beijing Bureau of Statistics, 2001–2011); the index of population was obtained according to the Tabulation on the 2010 Population Census of the Beijing Municipality (Town and Sub-district Volume) (Sixth national population census leading group office of Beijing, 2012) and the Tabulation on the Population Census of the People's Republic of China at Town and Sub-District level (2010) (The Census Bureau of the State Council et al., 2012).

### 3 Results

#### 3.1 Evolutionary structure and influencing effect of administrative divisions at the provincial level

##### 3.1.1 Evolutionary structure of administrative divisions at the provincial level

Since 1978, there have been two peaks in the adjustment of administrative divisions in China. During 1980–1996, an average of 31 cities was set up each year. In 1997, the approval of the policy of upgrading county to municipality was suspended, and the adjustment of administrative divisions progressed slowly. Since the twenty-first century, under the strong driving force of socio-economic development, during 2000–2010, the adjustment of administrative divisions in China increased dramatically, including changing county to urban district, upgrading county to municipality, and the combination of county and urban district. During that time, the city-governed districts increased by 66, and county-level cities and counties (including autonomous counties, banners, autonomous banners, forestry districts, etc.) decreased by 30 and 44, respectively. Many county-level administrative areas were changed into city-governed districts, as a whole, or split up, especially areas in the outward spatial expansion of mega cities. The number of city-governed districts increased from 787 to 853, the area increased from 441 225 km<sup>2</sup> to 628 573 km<sup>2</sup>, and the number of sub-districts in city-governed districts increased from 5902 to 7282, representing increases of 9.28%, 42.46%, and 23.38%, respectively.

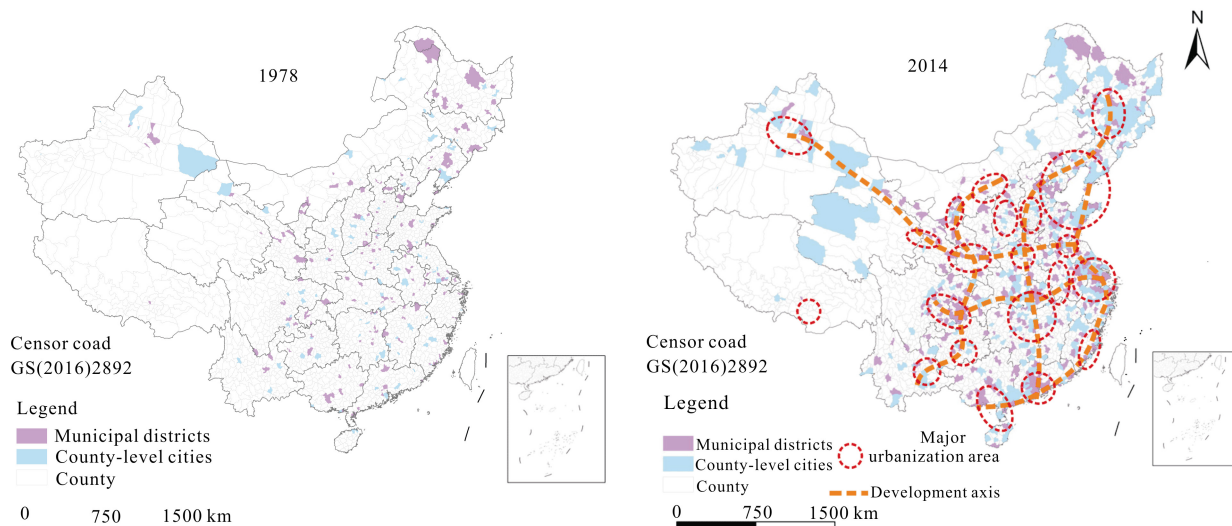
With the rapid growth of labor migration and urban population, urban administrative areas were also expanding, including those areas that have been upgraded from county to municipality, and the set-up of sub-districts, county-level cities, and city-governed districts. Chinese urbanization was closely related to the adjustment of administrative divisions. During 1978–2014, the number of city-governed districts, county-level cities, and counties continued to increase. Under the national strategy of T-type development along the coast and the Yangtze River (Lu and Yao, 2007), the adjustment of administrative divisions increased in priority development areas and key areas. The Yangtze River Delta and Pearl River Delta, among other regions, formed a spatial pattern with city-governed districts and county-level cities as the main types of administrative divisions (Fig. 1). In 2013, China had 872 city-governed districts and

368 county-level cities, and the urban density was 0.13/10<sup>3</sup> km<sup>2</sup>. The numbers of city-governed districts and county-level cities in Eastern China (Liu et al, 2012) were 397 and 162, respectively, and the urban density was 0.83/10<sup>3</sup> km<sup>2</sup>. The numbers in Central China were 315 and 138, respectively, and the urban density was 0.25/10<sup>3</sup> km<sup>2</sup>. In West China (the western China), the numbers were 160 and 68, respectively, and the urban density was 0.09/10<sup>3</sup> km<sup>2</sup>. The number of cities in the central and western China is far lower than that in the eastern China. As the central financial help and policy support for the different urban administrative areas varies, the urban infrastructure development, urban quality, and ability to attract foreign investment and other aspects differ greatly depending on the administrative level. Therefore, regions with higher levels of socio-economic development adopt the adjustment of administrative divisions to provide the institutional impetus for rapid urbanization.

##### 3.1.2 Influencing effect of administrative divisions at the provincial level

The patterns of Chinese urbanization include the migration mode (which can be subdivided into interprovincial migration and provincial migration according to the administrative area), the natural growth mode, and the growth mode of administrative divisions. Multiple modes coexist in the majority of provinces and cities (Table 1).

The changes of the physical boundaries of urban-rural areas caused by the adjustment of administrative divisions are the main reason for the change in the urbanization rate. Through adjustment of administrative divisions, such as upgrading county to municipality, changing county to urban district, and changing township to sub-district, the boundaries between rural and urban areas are redrawn, changing rural population into urban population and inflating the urban population statistics. This pattern can be seen, to various degrees according to Formula 1, in all 23 provinces and cities in China (Table 1). Through provincial adjustment of administrative divisions, the six provinces of Hebei, Henan, Jiangsu, Shandong, Guangdong, and Sichuan caused the newly increased urban population to increase by 116 900, 111 200, 105 900, 97 700, 81 500, and 71 000, respectively. They have therefore played a leading role in the apparent urban population growth in 75% of the Chinese provinces and cities.



**Fig. 1** Differences in China's administration settings between 1978 and 2014

The population growth characteristics, growth motivation, and spatial patterns of the other three patterns of urbanization are summarized and classified as follows: 1) interprovincial migration pattern. In this pattern, urban and rural population migrates between provinces and cities, and the population migrates to developed areas following the agglomeration of economic factors. These areas have high-speed economic growth, e.g., the Beijing-Tianjin area, the Yangtze River Delta, and the Pearl River Delta, including Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Fujian, and Guangdong. These cities have a strong capacity to absorb industrial population, accounting for 22.58% of that of the total provincial administrative areas. They are net in-migration dominant-type population change areas (Deng et al., 2014). The external flowing population is the main source of the urban population. The total interprovincial migration population has caused the urbanization rate to increase by 15.43%. 2) Provincial migration pattern. In this pattern, the provincial rural population migrates to cities and towns. The provincial center cities have a regional influence, attracting the rural population within the province to move there. There are 16 central cities, accounting for 51.61% of the total amount of provinces and cities in China, and their contribution to urbanization has reached 16.75%. 3) Natural growth pattern. This pattern's contribution to urbanization is limited, and the contribution rate is only 11.24%. This pattern exists in most provinces and cities with a relatively large population, such as Anhui, Henan, and so on. These

provinces and cities have large population outflows, and most of them belong to the net emigration type.

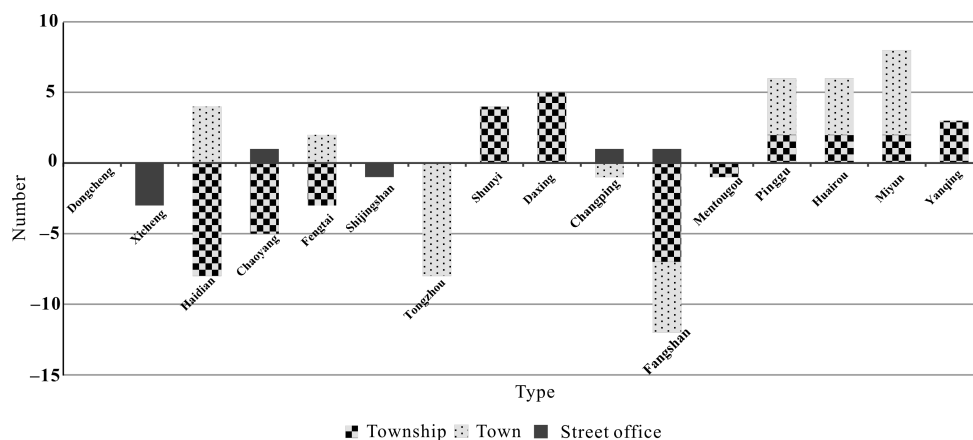
## 3.2 Evolutionary structure and influencing effect of administrative divisions at the municipal level

### 3.2.1 Evolutionary structure of administrative divisions at the municipal level

The adjustment of administrative divisions in China concentrated in big cities. Beijing, the capital city in China, experienced rapid economic agglomeration and continuous evolution of industrial structure and function. It was the city that has seen the most intensive adjustment of administrative divisions. Before 2000, Beijing mainly adopted the policy of changing county to urban district, including Tongxian, Shunyi, Changping, Daxing, Huairou, and Pinggu. During 2000–2010, a large number of villages and towns were upgraded to sub-districts or regional offices, forming four types: sub-district offices, regional offices, towns, and townships. In 2010, there were a total of 140 sub-districts, 142 towns, and 40 townships, including 54 regional offices (among which 29 regional offices subordinated to 25 towns, and others to townships). As the Beijing Economic and Technological Development Zone and the Yanqi Economic Development Zone and Industrial Development Zone did not belong to administrative areas, this paper did not consider them. After 10 years of adjustment of administrative divisions, the area of Beijing city-governed districts increased from 6496 km<sup>2</sup> to 12 187 km<sup>2</sup> (Fig. 2), an increase of 46.70%. The built-up

**Table 1** Source composition of the provincial urban permanent population (10<sup>6</sup> person)

| Provincial administrative region | 2010 urban population | 2000 urban population | New urban population | Interprovincial floating population | Provincial new urban population | Provincial migration effect | New rural-urban migrants | Provincial natural growth of cities | Provincial administrative division adjustment effect |
|----------------------------------|-----------------------|-----------------------|----------------------|-------------------------------------|---------------------------------|-----------------------------|--------------------------|-------------------------------------|--|
| Beijing                          | 16.86                 | 10.72                 | 6.14                 | 4.40                                | 1.74                            | 4.40                        | 0.22                     | 0.20                                | 1.32   |
| Tianjin                          | 10.28                 | 7.21                  | 3.07                 | 2.07                                | 1.01                            | 2.07                        | 0.06                     | 0.13                                | 0.82   |
| Hebei                            | 31.57                 | 17.59                 | 13.99                | -1.81                               | 13.99                           | 0.00                        | 1.21                     | 1.08                                | 11.69  |
| Shanxi                           | 17.16                 | 11.51                 | 5.65                 | -0.51                               | 5.65                            | 0.00                        | 1.65                     | 0.70                                | 3.31   |
| Inner Mongolia                   | 13.72                 | 10.14                 | 3.58                 | 0.33                                | 3.25                            | 0.33                        | 1.66                     | 0.42                                | 1.17   |
| Liaoning                         | 27.19                 | 22.99                 | 4.20                 | 0.09                                | 4.11                            | 0.09                        | 0.94                     | 0.26                                | 2.92   |
| Jilin                            | 14.65                 | 13.39                 | 1.26                 | -0.62                               | 1.26                            | 0.00                        | 0.43                     | 0.32                                | 0.52   |
| Heilongjiang                     | 21.32                 | 19.01                 | 2.31                 | -1.26                               | 2.31                            | 0.00                        | 0.68                     | 0.45                                | 1.17   |
| Shanghai                         | 20.56                 | 14.78                 | 5.77                 | 5.73                                | 0.04                            | 5.73                        | 0.17                     | 0.15                                | -0.28  |
| Jiangsu                          | 47.37                 | 30.86                 | 16.51                | 3.50                                | 13.01                           | 3.50                        | 1.69                     | 0.73                                | 10.59  |
| Zhejiang                         | 33.55                 | 22.76                 | 10.79                | 7.76                                | 3.03                            | 7.76                        | 1.61                     | 1.03                                | 0.38   |
| Anhui                            | 25.58                 | 16.65                 | 8.93                 | -4.81                               | 8.93                            | 0.00                        | 1.43                     | 1.08                                | 6.42   |
| Fujian                           | 21.06                 | 14.43                 | 6.63                 | 1.31                                | 5.32                            | 1.31                        | 1.99                     | 0.90                                | 2.43   |
| Jiangxi                          | 19.50                 | 11.46                 | 8.05                 | -1.76                               | 8.05                            | 0.00                        | 1.07                     | 0.96                                | 6.02   |
| Shandong                         | 47.62                 | 34.50                 | 13.12                | -0.91                               | 13.12                           | 0.00                        | 1.49                     | 1.86                                | 9.77   |
| Henan                            | 36.22                 | 21.47                 | 14.74                | -5.44                               | 14.74                           | 0.00                        | 2.43                     | 1.19                                | 11.12  |
| Hubei                            | 28.45                 | 24.24                 | 4.20                 | -2.68                               | 4.20                            | 0.00                        | 1.25                     | 0.72                                | 2.23   |
| Hunan                            | 28.44                 | 19.16                 | 9.29                 | -2.55                               | 9.29                            | 0.00                        | 1.66                     | 1.05                                | 6.57   |
| Guangdong                        | 69.02                 | 47.53                 | 21.49                | 5.98                                | 15.50                           | 5.98                        | 3.59                     | 3.76                                | 8.15   |
| Guangxi                          | 18.42                 | 12.64                 | 5.78                 | -1.33                               | 5.78                            | 0.00                        | 1.17                     | 1.05                                | 3.56   |
| Hainan                           | 4.31                  | 3.16                  | 1.15                 | 0.05                                | 1.10                            | 0.05                        | 0.29                     | 0.30                                | 0.52   |
| Chongqing                        | 15.30                 | 10.22                 | 5.07                 | -1.96                               | 5.07                            | 0.00                        | 1.05                     | 0.33                                | 3.69   |
| Sichuan                          | 32.35                 | 22.23                 | 10.12                | -1.38                               | 10.12                           | 0.00                        | 2.34                     | 0.68                                | 7.10   |
| Guizhou                          | 11.74                 | 8.41                  | 3.32                 | -2.10                               | 3.32                            | 0.00                        | 0.95                     | 0.72                                | 1.66   |
| Yunnan                           | 15.96                 | 10.02                 | 5.94                 | -1.07                               | 5.94                            | 0.00                        | 0.63                     | 0.84                                | 4.47   |
| Tibet                            | 1.15                  | 0.80                  | 0.34                 | 0.02                                | 0.32                            | 0.02                        | 0.01                     | 0.09                                | 0.22   |
| Shannxi                          | 17.06                 | 11.63                 | 5.43                 | -0.61                               | 5.43                            | 0.00                        | 1.30                     | 0.48                                | 3.65   |
| Gansu                            | 9.19                  | 6.15                  | 3.04                 | -0.80                               | 3.04                            | 0.00                        | 0.50                     | 0.40                                | 2.13   |
| Qinghai                          | 2.52                  | 1.80                  | 0.72                 | 0.05                                | 0.67                            | 0.05                        | 0.21                     | 0.18                                | 0.28   |
| Ningxia                          | 3.02                  | 1.82                  | 1.20                 | 0.04                                | 1.16                            | 0.04                        | 0.23                     | 0.20                                | 0.73   |
| Xinjiang                         | 9.33                  | 6.51                  | 2.82                 | 0.24                                | 2.58                            | 0.24                        | 0.37                     | 0.75                                | 1.46   |



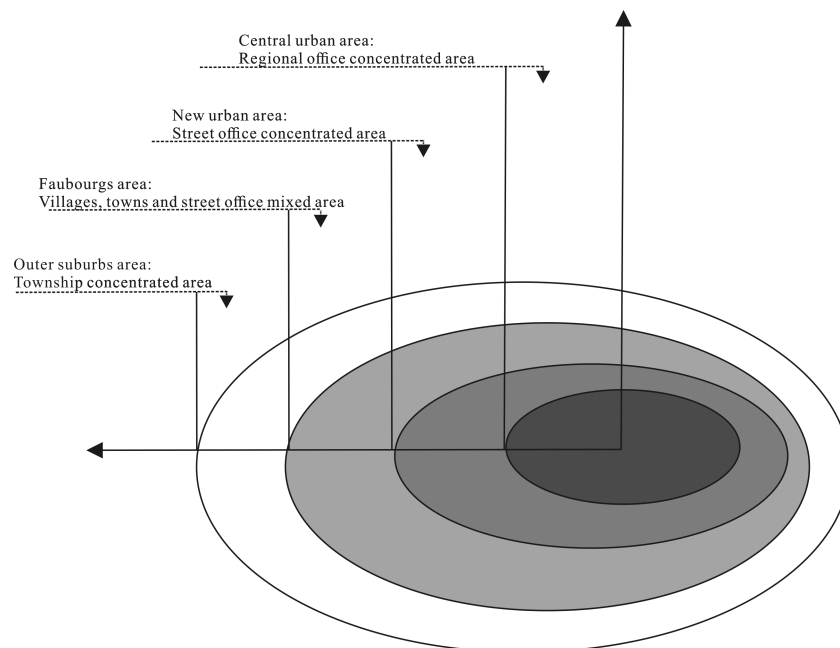
**Fig. 2** Quantity changes of Beijing's administration regions

area increased from 488 km<sup>2</sup> to 1186 km<sup>2</sup>, an increase of 58.85%. Therefore, we chose the city of Beijing as a case study to analyze the pattern and effect of the adjustment of administrative divisions at the municipal level.

Beijing's administrative division system included six types, they were municipal district, county, sub-district, town, township, and regional office. During 2000–2010, the sub-districts of the four districts of the old city remained unchanged. The four districts were Dongcheng District, Chongwen District, Xicheng District, and Xuanwu District. The Chongwen District and Dongcheng District have since been merged into the new Dongcheng District, and Xicheng District and Xuanwu District have been merged into the new Xicheng District. The central urban area mainly adopted the patterns of set-up, revoking, and merging of sub-districts, such as Haidian District, Fengtai District, and Shijingshan District. The new urban areas mainly adopted the pattern of changing towns and townships to regional offices, such as Tongzhou District, Mentougou District, and Changping District. The outlying districts and counties mainly adopted the pattern of changing townships to towns. Over the 10 years of adjustment of administrative divisions, the administrative regions now have show a typical concentric circle distribution (Fig. 3). The central urban area was the core, while the central sub-district

offices, regional offices, the mixed distribution area, and the fringe townships formed four circles in sequence. The central urban area within the 5th ring road mainly adopted the sub-district as its administrative division, whereas a number of regional offices have been added in the transition zone between the 5th ring road and 6th ring road. The outlying districts and counties mainly adopted the form of sub-district, while the other areas still adopted the forms of towns and townships. Remote areas mainly adopted the form of townships.

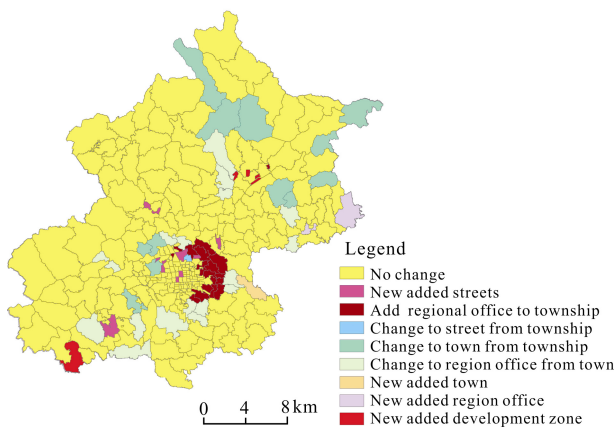
The adjustment of administrative divisions in Beijing has adopted five patterns (Figs. 4, 5): 1) Set-up of sub-districts: 25 sub-districts have been set up, accounting for 32.47% of the total adjustment. These sub-districts gather in the newly developed urban areas, including the Financial sub-district and Shichahai sub-district in Xicheng District, the Olympic village sub-district, the Capital airport sub-district, and East lake sub-district in Chaoyang District, and the newly developed sub-districts of Haidian District, Fangshan District, Shunyi District, Daxing District, Huairou District, and Yanqing District. These sub-districts have been created mainly through changing town to sub-district, dividing sub-districts and then merging them into new sub-districts, and merging areas outside the sub-districts. 2) Set-up of regional offices: 35 regional offices have been set up, accounting for 45.45% of the total adjustment. These offices gather



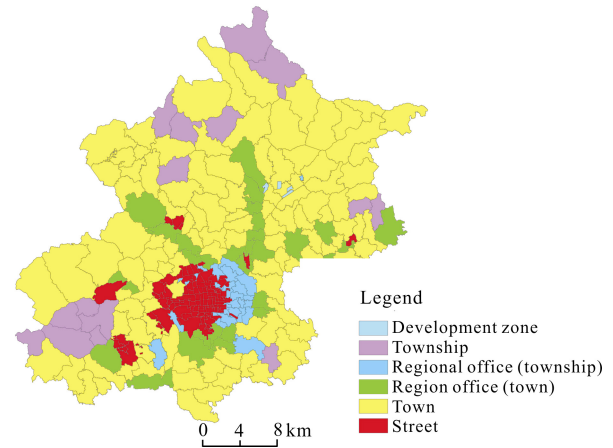
**Fig. 3** Spatial distribution patterns of the administrative regions in Beijing



in Chaoyang District and are closely related to population growth. In 2000, the population of these newly increased areas was 1.8431 million. By 2010, the population had increased to 4.4286 million, an increase of 140.28%, while the city's population growth rate was only 56.78% over the same period. This process is mainly to add new management functions to the sub-districts. 3) Changing townships to sub-districts: only one township was changed to sub-district, accounting for 1.30%. The population, economic level, public service supply, and other aspects of townships are very different from those of sub-districts. The only case was the change of Datun township to Datun sub-district. This change was made with regard to the hosting of the Olympic Games in Beijing. 4) Upgrading townships to towns: 13 townships were upgraded to towns, including Changxindian Town, Wangzuo Town in Fengtai District, Wenquan Town, Sijiqing Town in Haidian District, Liulimiao Town, Baoshan Town in Huairou District, Liujiadian Town, Zhenluoying Town in Pinggu District, Dongshaoqu Town, Beizhuang Town, Xinchengzi Town, and Shicheng Town in Miyuan District, accounting for 16.88%. These were important measures adopted by the outer suburb areas to promote the construction of satellite towns, in order to cope with the rapid growth of the suburban population and economy. 5) Set-up of towns and new regional offices: This took place in the Yuyang Area and Jinhaihu Area in Pinggu District, accounting for 2.60%. The former case reflected the policy of revoking townships and merging them into towns; the latter case reflected the policy of merging townships and towns and directly setting up regional offices.



**Fig. 4** Spatial evolution of the administration organizational system in Beijing (2000–2010)



**Fig. 5** Spatial distribution of the administration zones of Beijing (2010)

### 3.2.2 Influencing effect of administrative divisions at provincial and municipal levels

During 2000–2010, the Beijing urban population grew from 10.522 million to 16.859 million, part of which was caused by the adjustment of administrative divisions (Table 2). We calculated the total urban population of each administrative unit on the basis of its urbanization rate. By subtracting the population changes of immigrant population and the natural growth of urban resident population from the total urban population, the change of urban population caused by the adjustment of administrative divisions could be calculated (Table 2). The validation formula is:

$$UP_{aa} = (\Delta UP - \Delta UP_N - \Delta UP_c)$$

where  $UP_{aa}$  is the newly increased urban population caused by the adjustment of administrative divisions;  $\Delta UP$  is the change of urban population during 2000–2010;  $\Delta UP_N$  is the immigrant population (most of which live in towns);  $\Delta UP_c$  is the natural population growth of the urban resident population; and  $n$  is the total number of adjusted townships and sub-districts.

Considering all the townships and sub-districts involved in the adjustment of administrative divisions, two kinds of situations are found: 1) Incorporating all the situations in the near and outer suburb areas of towns being changed to sub-districts and sub-districts being upgraded to districts, the result is 1.3791 million people. 2) Not incorporating the situation of towns being changed to sub-districts and sub-districts being upgraded to districts (Because these places are concentrated areas for urban population, the set-up of



sub-districts has little impact on the urban population statistics. Whether setting up sub-districts or not, these areas belong to the municipal areas, and the population is urban population), the result is 1.3185 million people. The results of the above two situations are 59 100 and 2500 people, respectively, less than the 1.32 million people—the results calculated by the above pattern—with error rates of 4.48% and 1.89%, respectively. This suggests that the adjustment of administrative divisions affects the urban population statistics to a large extent. Many people who in fact do not belong to the urban population are counted as urban population, because of the adjustment made to administrative divisions.

Further analysis of the socio-economic effect of the adjustment of administrative divisions was shown in Table 3. Since 2000, the townships and sub-districts that have undergone the adjustment of administrative divisions have shown dramatic changes in the following fields: newly increased permanent population, newly increased enterprises, newly increased secondary industry enterprises, newly increased tertiary industry enterprises, and amount of land for urban construction, compared with those areas that did not undergo such adjustment. The newly increased permanent population, newly increased secondary industry enterprises, and the amount of land for urban construction have increased dramatically, while the number of newly increased en-

terprises and newly increased tertiary industry enterprises has reduced significantly. As the adjustment of administrative divisions in the Beijing urban area is focused on the outer suburban counties of the city—the important area for infrastructure construction and residential suburbanization—the absorption quantity of the flowing population and the urban construction speed are higher. At the same time, under the strategy of suppressing the second industries and developing the tertiary industries, more and more secondary industry enterprises have moved to the urban function development zone and the newly developed zones with good geographical conditions and supporting policies, so the number of secondary industry enterprises has increased significantly. However, under the background of industrial structure, i.e., in terms of contribution to GDP, tertiary industry should be the first, secondary industry should be the second and primary industry should be the last. The number of newly increased enterprises, especially the number of newly increased tertiary industry enterprises, is far less than those fostered in the core functional area of the capital. Through detailed analysis of the different effects of the different kinds of adjustment of administrative divisions, we found that the three kinds of areas that have undergone adjustment of administrative divisions (including townships upgraded to towns, towns upgraded to districts, and townships upgraded to districts) are the main spaces for urban development

**Table 2** Urbanization validation caused by the administrative divisions in Beijing (2000–2010) ( $10^4$  people)

| Municipal district or county | 2000                          |                            |                            |  | 2010                          |                            |                            |  |
|------------------------------|-------------------------------|----------------------------|----------------------------|--|-------------------------------|----------------------------|----------------------------|--|
|                              | Permanent resident population | Township population growth | External population growth | Natural growth of urban household registration | Permanent resident population | Township population growth | External population growth | Natural growth of urban household registration |
| Chaoyang                     | 96.2207                       | 84.3986                    | 52.2455                    | -128   | 201.6123                      | 186.3632                   | 86.1615                    | 7103   |
| Fengtai                      | 15.9007                       | 13.0571                    | 6.0589                     | -49  | 23.4428                       | 9.0258                     | 3.9185                     | 121  |
| Haidian                      | 37.7413                       | 34.8687                    | 20.6292                    | 418  | 58.5154                       | 56.1071                    | 22.4003                    | 2393   |
| Mentougou                    | 1.2799                        | 0.836858                   | 0.2437                     | -29  | 0.6513                        | 0.4957                     | 0.1056                     | -27  |
| Fangshan                     | 343.5467                      | 11.8644                    | 5.5939                     | 307  | 47.9371                       | 18.7298                    | 7.2215                     | -346   |
| Tongzhou                     | 31.3233                       | 10.0213                    | 8.1740                     | 66   | 33.5714                       | 16.7172                    | 12.3341                    | -761   |
| Shunyi                       | 21.6665                       | 4.7610                     | 7.6585                     | -164   | 40.9942                       | 20.8426                    | 13.0415                    | -852   |
| Changping                    | 27.9297                       | 6.1373                     | 12.9581                    | -435   | 97.6377                       | 59.7871                    | 49.7888                    | -1011  |
| Daxing                       | 38.0564                       | 11.2439                    | 15.9611                    | 1126   | 91.4605                       | 34.2490                    | 33.2053                    | 786  |
| Huairou                      | 16.9321                       | 5.2792                     | 5.4536                     | 355  | 23.9301                       | 6.1181                     | 3.8833                     | -1232  |
| Pinggu                       | 19.1104                       | 4.7899                     | 2.3916                     | -55  | 24.1573                       | 6.9774                     | 1.6923                     | -982   |
| Miyun                        | 4.7366                        | 1.1071                     | 0.4212                     | -134   | 19.8381                       | 1.6341                     | 0.6054                     | -1308  |
| Total                        | 654.4443                      | 188.3653                   | 137.7893                   | 1278   | 663.7482                      | 417.0470                   | 234.3581                   | 3882   |

Note: Table 2 does not consider the situation of towns being changed to sub-districts and sub-districts being upgraded to districts.

**Table 3** *T*-test results of the administrative division adjustment effect

| Adjustment category                     | New permanent residents | Number of new enterprises | Number of new industrial enterprises added | Number of newly added tertiary industry enterprises | New land for urban construction (sq.km.) |
|---|-------------------------|---------------------------|--|---|--|
| Division adjustment                     | 60091 <sup>***</sup>    | 485 <sup>***</sup>        | 31 <sup>*</sup>                            | 454 <sup>***</sup>                                  | 6.32 <sup>*</sup>                        |
| Change to town from township            | 48389                   | 235 <sup>**</sup>         | -13  | 248 <sup>**</sup>                                   | 11.3 <sup>*</sup>                        |
| Change to regional office from town     | 114579 <sup>***</sup>   | 855 <sup>*</sup>          | 121 <sup>***</sup>                         | 734 <sup>*</sup>                                    | 9.94 <sup>*</sup>                        |
| Newly added regional office to township | 44890 <sup>*</sup>      | 360 <sup>***</sup>        | -23 <sup>**</sup>                          | 362 <sup>**</sup>                                   | 5 <sup>*</sup>                           |
| Newly added sub-districts               | 24739                   | 446 <sup>**</sup>         | 20   | 427 <sup>**</sup>                                   | 0.8 <sup>**</sup>                        |
| No division adjustment                  | 21046                   | 615                       | 20   | 592   | 2.8                                      |

Note: <sup>\*</sup> indicates a significant level of 0.1; <sup>\*\*</sup> indicates a significant level of 0.05; <sup>\*\*\*</sup> indicates a significant level of 0.01

and population concentration. Among which, the newly increased permanent population of the districts upgraded from towns is 114,500 people, which is almost six times the number in the areas without adjustment of administrative divisions. Meanwhile, the increased amount of land for urban construction in the towns upgraded from townships is 11.3 km<sup>2</sup>, which is nearly five times the size in the areas without adjustment of administrative divisions. From the point of industrial structure and development speed, the above three kinds of areas have another obvious regional differentiation. The districts upgraded from towns cover the economic and technological development zones and key new areas giving priority to construction, among which the number of all kinds of new enterprises is significantly high. The other two kinds of areas mainly gather in Chaoyang District, where the number of secondary industry enterprises has significantly decreased under the influence of the Ya'ao Economic Zone and development philosophy.

## 4 Discussion

### 4.1 Adjustment of administrative divisions presents different patterns in different scales in China urbanization

China's administrative division is a typical wide-area regional management system, which is different from that of foreign countries. For a long time, the administrative division of China is under constant change, and the power of the adjustment in history is mainly due to the political management, spatial configuration of military force and terrain conditions. Since China's reform and opening up, Chinese socio-economic development became the dominant mode of urbanization, which ac-

celerated the growth of the urban population, size and function. Expanding the size of cities, improving the capacity of cities, optimizing population management and supply of public services has become the main driving force for the adjustment of administrative divisions in China. On the adjustment mode of it, China's administrative division adjustment in various levels of province, city and county model has bigger difference. The provinces adjust involves political power matching, sensitive, so there is almost no change. In metropolitan areas and counties, such as the administrative regions driven by cities, there is a large scale adjustment, among which, the metropolitan area adjustment always select expand the central city scale as the main mode; county area is accomplished mainly through the promotion of city administration level. If the adjustments take place between metropolitan area and county at the same time, the result of the adjustment is influenced by the urban development demand, administrative power and financial strength, which need to be analyzed in detail in the future.

### 4.2 Adjustment of administrative divisions causes inflation of the urbanization rate statistics

The adjustment of administrative divisions contributes to the difference in the numbers of cities in Eastern China, Central China, and West China, indirectly affecting the urbanization rate statistics. The adjustment of administrative divisions causes inflation of urbanization rate statistics. The pattern of the adjustment made to administrative divisions is a significant factor leading to inflation of the urbanization rate at the provincial level in China. Through adjustment of administrative divisions, the original urban-rural combination

areas are directly changed to urban areas. These areas, including a large amount of rural areas or mixed urban-rural areas, are changed to city-governed districts (Cai, 2010). Part of the agricultural population is directly changed to non-agricultural population, without any substantial urbanization having taken place. In particular, the upgrading of county to municipality (city-governed district) has caused inflation of the urbanization rate. This opinion quantitatively validates the conclusion made by predecessors, i.e., in the process of China urbanization, population migration only plays a secondary role (Ma, 1990; Wang, 1993, 2008), and adjustment of administrative divisions is the direct reason (Luo, 2005).

#### **4.3 Adjustment of administrative divisions has the agglomeration lock and the continuous accumulative effect**

The administrative division upgrade has the significant element flow lock effect, which could accelerate population inflow, strengthen the support for regional construction of public facilities, guiding the continuous growth of population. The development of businesses and real estate industries and the construction of industrial parks and development zones in the outer suburban counties of Beijing city have resulted in a large number of people finding jobs and living there. These areas have become the key areas for the adjustment of administrative divisions, including the Huilongguan sub-district in Changping District, Wangjing sub-district and Tuanjiehu sub-district in Chaoyang District, Chengbei sub-district in Changping District, Shiyuan sub-district in Shunyi District, Zhongcang sub-district in Tongzhou District, and Gongchen sub-district in Fangshan District. These sub-districts have been upgraded from townships or towns, thus becoming the new sub-centers of Beijing city. During 2000–2010, the difference in population density between the sub-districts, towns, and townships in Beijing increased. The spatial distribution of the Beijing population has shown macro-proliferation and local agglomeration (Liu et al., 2013). The populated areas scatter along the 5th ring road and the 4th ring road, and extend radically outward along the axis of the major roads, including the Beijing–Tibet expressway, and Beijing–Tongzhou District (Sun et al., 2012). In these areas, the administrative areas are sub-districts upgraded from townships or towns.

#### **4.4 Adjustment of administrative divisions accelerates the evolution of the urban spatial structure**

The adjustment of administrative divisions plays an important role in China urban spatial structure and the reshaping of the urban form, optimizing the urban function and public services. The urban spatial structure is changed from compact spaces with single cores and circular zones to spaces with multiple cores and circular zones, affecting the pattern of urban development from the aspect of policies. The evolution of the Beijing spatial form caused by the adjustment of administrative divisions has shown three typical stages. The first stage was characterized by the expansion of the central urban area, dominated by the adjustment or the set-up of sub-districts. The central urban area adopted the sub-districts as the only administrative divisions. The suburban counties kept the mixed form that combines urbanization with rural areas, while towns and townships were the main administrative areas for the urbanization. The second stage featured the set-up of regional offices in the urban-rural combination area and the set-up of sub-districts in each block of the surrounding areas. The population spillovers of the central urban area and the newly increased flowing population led to large population agglomeration in the urban-rural combination area, requiring population management and public services far beyond the city's supply capacity. Therefore, the Beijing municipal government added regional offices on the basis of township government, assigning township government the privilege of governing the city. Faced with the influx of enterprises and their dependent population into the suburban counties, the method of changing township to sub-district was utilized to enhance the capacity of urban management. The third stage involved the growth of the set-up of multi-center sub-districts. This mainly refers to the fact that regional offices set up in the urban-rural combination area were changed to sub-districts. Non-city townships and towns were changed to sub-districts because of the expansion of the suburban counties. The suburban population formed satellite cities through the administrative division of major sub-districts.

In general, changing township to sub-district and changing regional office to sub-district is undertaken to meet the needs of urban public services and the management of large urban population agglomeration. However, the continuous set-up of sub-districts has

meant that the central urban area and outer suburb counties are becoming urbanization regions, causing the urban spatial form to sprawl. This is closely related to the Beijing urban transportation infrastructure. In the mid- and late-1990s, Beijing accelerated the construction of the urban rail transit, urban expressways, and radiating roads, promoting the adjustment of industrial structure and the spatial reconstruction and migration of population and labor. The urban spatial structure has gradually moved to the characteristics of multi-centers and groups. The rapid development of the urban-rural combination areas and the central towns in the outer suburb counties has promoted the set-up of regional offices and the process of changing township to sub-district.

The adjustment of administrative divisions and urban functional refinement is a process of interaction and a continuous cycle (Fig. 6). The functional displacement of the city of Beijing has promoted the adjustment of administrative divisions, and the latter in turn has provided an institutional power for the optimization of the urban function. Under the guidelines of gradually reconstructing the old city, adjusting the supporting facilities of the suburbs, and promoting the development of the outer suburb counties, Beijing has encouraged the development of the modern service industries and mid- to high-end industries, promoting the all-around set-up of sub-districts in the central urban area and the set-up of sub-districts in the towns of the suburban counties. Meanwhile, upgrading townships to sub-districts or regional offices improves the level of public service, attracting agglomeration of population and enterprises,

and optimizing the urban industrial structure and function. During 2000–2010, the adjustment of administrative divisions in Beijing resulted in great changes in the industrial spatial structure and population distribution, increasing the industry level of the central urban area and promoting the industrial land occupancy to move from the central fringe area to the outer suburb counties. This has made the population suburbanization more significant, with the area between the 4th ring road and 5th ring road becoming the fastest population agglomeration area. This in turn has promoted the changing of sub-districts and the set-up of regional offices. But it should be noted that because of the administrative division adjustment has significant hysteresis effect, the impact on the element concentration may be invisible, this creates that it is difficult to fully distinguish the select elements to what extent is affected by the administrative division adjustment, which makes the research conclusion only reflect the influence degree roughly to urban development. However, this method may be the better choice under the limited data samples. The follow-up research will study how to establish the influence degree of distinguishing factors so as to improve the accuracy of the study of the adjustment effect.

## 5 Conclusions

The adjustment of administrative divisions makes huge differences in the number of cities in different areas in China urbanization process. It releases the institutional energy for urban economic and social development.

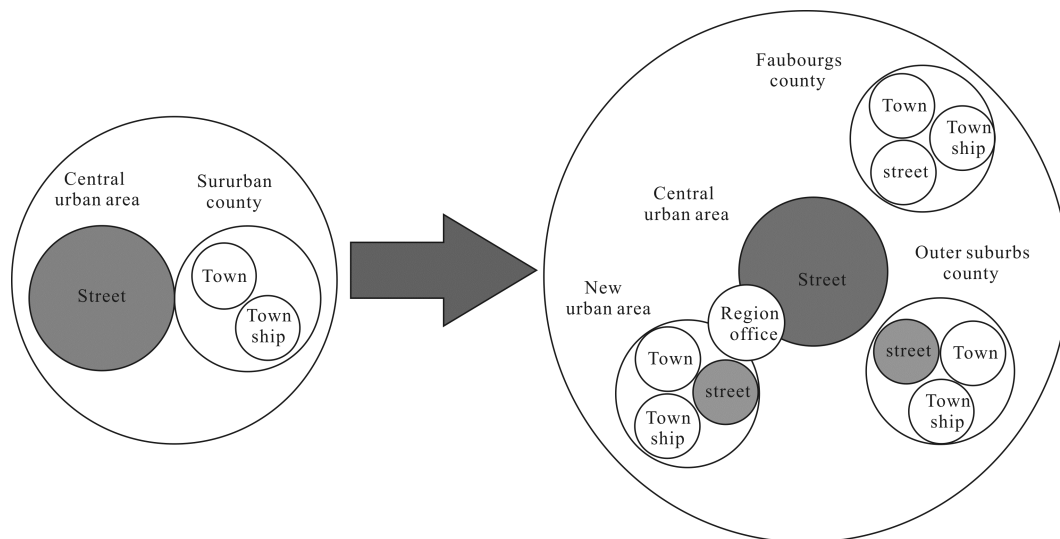


Fig. 6 Urban spatial structure changes of the administration zone in the metropolitan area

Upgrading county to municipality (or city-governed district) is the main way for the adjustment of administrative divisions at the provincial level. It is also an important factor in the spatial differentiation of interprovincial urbanization. Chinese population urbanization can be divided into four patterns—interprovincial migration, provincial migration, natural growth, and growth caused by the adjustment of administrative divisions—among which the change of household registration caused by the adjustment of administrative divisions causes inflation of the Chinese urbanization rate at the provincial level. This is evidently embodied in the six provinces of Hebei, Henan, Jiangsu, Shandong, Guangdong, and Sichuan.

The adjustment of administrative divisions at the municipal level includes the five patterns of the set-up of sub-districts, the set-up of regional offices, the upgrading of townships to sub-districts, the upgrading of townships to towns, and the set-up of towns and new regional offices. The quantitative analysis of the effect on population and social economy caused by the adjustment of administrative divisions at the municipal level showed that the adjustment has a significant effect on the differential characteristics and type classification. The adjustment of administrative divisions is accompanied by the expansion of city scale and space. This takes place in three stages: the expansion of the central urban area, dominated by the adjustment or set-up of sub-districts as the first stage; the set-up of regional offices in the urban-rural combination area and the set-up of sub-districts in each block of the surrounding areas as the second stage; and the growth of the set-up of multicenter sub-districts as the third stage. This promotes the adjustment and reconstruction of the urban population and industrial structure, playing an important role in the evolution of the urban spatial structure moving to the characteristic of multicenter and group. Meanwhile, the growth pattern of the adjustment of administrative divisions is a significant factor leading to inflation of the urbanization rate.

The adjustment of administrative divisions in China attaches great importance to the urban space and expansion of the land area, ignoring the power of the government and the matching of urban functions. As the subsequent construction of infrastructure and management function cannot meet the demands of the rural areas that have undergone adjustment of administrative divisions,

these adjusted rural areas usually lack substantial urban construction. Combined with the growth of population flow, the urban management problems cannot be solved in the short term, severely restricting the beneficial effect of the adjustment of administrative divisions. Reasonable adjustment standards and timing should be formulated to regulate the managerial scope and scale of administrative areas at all levels, matching the function of administrative areas with urban management.

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