Urbanization of county in China: Spatial patterns and influencing factors

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Abstract: This paper uses the fifth and sixth census data and 2018 demographic statistics to analyze the spatiotemporal evolution of the urbanization of county in China and the factors that influence the evolution. The paper reveals that the urbanization level of counties is a weak area in China's overall urbanization. During the period from 2000 to 2010, the spatial patterns of the urbanization level of counties remained stable. Counties with high-level urbanization were concentrated in the coastal areas of the eastern region, while counties that experienced rapid urbanization were mainly located in the central and western regions. Regression analyses indicate that harsh natural endowments that constrain economic development are the most important factors that hinder the urbanization of county; these factors include marginalized locations far away from center cities, high altitudes, and a population with a low education level. This paper also compares two theoretical modes of new-type urbanization, nearby urbanization and remote urbanization, and argues that the new-type urbanization of county is the main form of nearby urbanization and provides an example of urbanization for developing countries worldwide.

Keywords: new-type urbanization; urbanization of county; nearby urbanization; spatial patterns; influencing factors

1 Introduction

Since the reform and opening up, urbanization has rapidly progressed in China and the achievement has caught the attention of the entire world. The urbanization rate rose from 17.92% in 1978 to 63.89% in 2020, representing an annual increase of 1.09 percentage points. The total urban population grew from 172 million in 1978 to 902 million in 2020, an increase by 4.24 times (NBSC, 2021). In 2014, the National New-type Urbanization Plan
The new-type urbanization strategy has been implemented (Bai et al., 2014) and has significantly enhanced the process of people-oriented urbanization and citizenization (i.e., granting permanent urban residency to rural migrant workers). In May 2020, the National Development and Reform Commission issued the Notice on Accelerating Urbanization of County Seats and Strengthening Weak Areas, which pointed out that county seats or the urban areas of county-level cities play a critical role in China’s socioeconomic development. According to the notice, these urban areas are important spaces for enhancing the industrialization and urbanization of China, are important links in China’s urban system, and are key connections in the integrated development of urban and rural areas. However, county seats still cannot provide sufficient support for economic development and meet peoples’ need for a better life because of certain constraints in terms of public health, living environment, public services, municipal infrastructure, and industrial development (Liu et al., 2015; Chen et al., 2018). Therefore, the urbanization of county is an important part of people-oriented new-type urbanization and has a long way to go.

Existing research on China’s urbanization typically examines the spatial patterns, influencing factors, and driving mechanisms at different spatial scales. At the provincial level, the urbanization level gradually decreases from the eastern region to the central and western regions. At the prefecture level, regions with an urbanization rate higher than the national average are mainly concentrated in developed areas along the east coast, traditional industrial areas in the northeast, energy-rich areas in the northwest, and certain inland provincial capitals (Liu et al., 2016). There is a growing body of literature on urbanization at the county level; however, the research mainly uses household registration (Hukou) data to analyze the spatial characteristics of urbanization for all county-level administrative units and therefore is merely an extension of the research at the provincial and prefecture levels. Influenced by the interaction of a variety of factors, such as the dual urban-rural structure, government policies, and the market, there is evident diversity in the influencing factors and driving forces of urbanization in the counties of China. In the late 1990s, the “bottom-up” foreign-investment-driven urbanization process was investigated based on typical regional analyses (Zhu, 1998). In recent years, some scholars have tried to understand the driving force of urbanization by examining the impetuses of the government, market, and civil society; other researchers have attributed the diversified factors influencing urbanization to administration forces, market forces, exterior forces, and intrinsic forces. Certain research focuses on the impact of land policies and the market on China’s urbanization process; some recent research maintains that population mobility has an increasing impact on urbanization (Shen et al., 2016). Spatial statistical analyses, comprehensive evaluations, multi-regression analyses, and the geodetector method are the commonly employed methods for urbanization analysis. Overall, the research discussed above has expanded the perspective and methodology for studying urbanization patterns and the driving forces.

The new-type urbanization strategy constitutes a higher requirement for both the development practice and theoretical research of China’s urbanization. In urbanization practice, an ever-growing number of rural migrant workers are counted as permanent urban residents in statistics. However, the majority of these workers do not enjoy the living standards of regular urban residents, with no access to health care, education, affordable housing, and
other public services that are available to regular urban residents (Peng et al., 2015; Chen et al., 2019). As a substantial amount of the rural population migrate out of the countryside, rural areas are emptying with the ageing population. Therefore, public services and infrastructure development are lagging, and the protection and inheritance of local culture is insufficient (Dunford and Li, 2010; Chen et al., 2014; Li et al., 2015). Research on new-type urbanization has focused on the intention and characteristics of this new strategy, the measurement methods, and its spatio-temporal patterns. Chen et al. (2019) maintained that the theoretical intention of the new-type urbanization should at least encompass four aspects: humanism, inclusivism, harmonization, and sustainability. Liu and Yang (2012) proposed that the urbanization of county in China varies significantly among regions, and counties along the country borders in northern China and those along the east coast have a high level of urbanization. Wang and Li (2016) examined variances in the growth of urbanization rates in China between 2000 and 2010 and found that the growth in urbanization among regions demonstrates a trend of catching up and convergence. Areas with a lower level of urbanization have a higher growth rate than those with a higher level of urbanization; specifically, urbanization in the central and western regions is accelerating, and the urbanization growth rate in the central region is higher than the national average.

In summary, the research discussed above mainly uses all the county-level administrative units to analyze the spatio-temporal patterns of China’s urbanization, and does not differentiate among counties, county-level cities, or municipal districts of large cities. In long-term urban development practice, municipal districts of large cities have been granted more capital and land resource support and have achieved fast development, while counties and county-level cities are developing at a slower pace. Therefore, the urbanization of counties and county-level cities is significantly different from that of municipal districts of large cities, especially in terms of infrastructure development and public service provisions (Li and Liu, 2019).

Therefore, this paper proposes that the urbanization of county is an important approach to enhancing people-oriented urbanization and will focus on the spatio-temporal evolution of urbanization in county-level cities and counties, and examine the factors that influence the evolution. The research will exclude the municipal districts of large cities, which are already predominantly urbanized areas. We hope that the research findings will help to strengthen the weak areas in the urbanization of county that were exposed during the COVID-19 pandemic and inform decision-making with regard to the implementation of the new-type urbanization strategy. The innovation of this paper is reflected in three aspects: first, an analysis framework is proposed for new-type urbanization in counties and its relationship with new-type urbanization; second, the paper reveals the spatio-temporal pattern of new-type urbanization in counties; and third, this research analyzes the factors that influence new-type urbanization in counties.

2 Two theoretical modes of new-type urbanization

2.1 Nearby urbanization and remote urbanization

Rural workers off their land have two choices. One is to move to large cities far away from their hometowns. The other is to move to county seats or other small towns near their
hometowns (Li, 2015). Therefore, there are two theoretical modes for the new-type urbanization: nearby urbanization and remote urbanization. Nearby urbanization refers to the urbanization mode in which rural residents enter into towns that act as service centers for the surrounding areas or into county seats, both of which are still close to their original place of living and have more non-agricultural employment opportunities for employment and living, and become urban residents of these towns (Wang and Pang, 2015). Remote urbanization mainly refers to the urbanization mode in which rural residents flow into large cities that are far away from their original residence, temporarily or permanently work and live in these large or medium-sized cities, become permanent residents of these cities, and realize the conversion of identification from rural residents to urban residents (Long et al., 2009).

With large-scale population mobility, remote urbanization is currently the main mode through which rural residents convert to urban residents. On the one hand, there is a prominent dual urban-rural structure and a significant development gap that exists between urban and rural areas. In 2020, the per capita disposable income of urban residents was 43,834 yuan, while that for rural residents was 17,131 yuan, accounting for only 39.08% of that of the urban residents. On the other hand, there is a significant disparity between the less developed areas in the central and western regions and the developed areas of the eastern coastal and provincial capital cities. The great disparity has promoted large amounts of rural population in the central and western regions to migrate to large- and medium-sized cities in the developed areas of the eastern coastal regions (Liu et al., 2016). At the end of 2020, there were 170 million rural migrant workers across China, 71 million of whom were inter-provincial migrant workers, accounting for 41.76% of the total migrant population. These migrant rural workers left their original place of residence and obtained employment in non-agricultural sectors in other cities. Furthermore, more than 70% of the migrant workers intended to stay in their current place of residence for over five years.

Nearby urbanization is an important way of new-type urbanization and a supplement to traditional remote urbanization (Liu and Yang, 2012; Liu et al., 2017). With industrial upgrading in the eastern coastal regions and labor-intensive industries relocating to the central and western regions, county-level economic development in the central and western regions has made significant progress. Many rural migrant workers have returned and secured non-agricultural employment in towns and county seats near their hometowns that serve as service centers of the surrounding area and places with high concentrations of township and village enterprises and private firms. On the other hand, with the implementation of the rural revitalization strategy and the rural poverty alleviation strategy, the income of rural residents has been steadily growing; an increasing number of rural residents are buying houses in the towns that serve as service centers and county seats. This trend has also contributed to the shift in rural resident lifestyle to an urban lifestyle.

2.2 Main issues in remote urbanization

In the remote urbanization process, migrant rural workers do not have access to the public services and social welfare enjoyed by urban residents due to the dual restraints of the household registration system and their income level (Peng et al., 2015; Xu, 2017). In addition, a large population moving to large cities has accentuated the “city disease” issue (Liu et al., 2016). Traffic congestion, high housing prices, scarcity of resources, and other social
issues have restrained the development of large cities, especially megacities. Nearby urbanization can help alleviate the burdens of large cities and ease their environmental pressures. Therefore, nearby urbanization is conducive to developing a reasonable urban system and mitigating the “city disease.”

Under the remote urbanization mode, a large amount of rural population moves out, and the countryside becomes seriously “hollowed.” With the younger rural labor force migrating to large cities, the hollowing and population ageing in rural areas have become increasingly prominent, and rural public services cannot meet the needs of rural and agricultural development, which further reinforces the force to “push” the rural population out of the countryside. With the self-reinforcing mechanism, a large number of villages that have borne thousands of years of culture rapidly disappeared, as did the rural culture (Wang and Zhang, 2018). At the same time, a large number of left-behind children, left-behind women and empty-nesters have appeared in rural areas, bringing many social problems to rural areas. Nearby urbanization, wherein rural residents are off land but still close to their hometown, can help rural labor force find non-agricultural employment close to their place of living and alleviate the “hollowed village” issue and the social issues related to people staying behind.

2.3 The realistic need for nearby urbanization

With the development of coastal regions and urban agglomerations, remote urbanization has made great progress. Nearby urbanization, especially urbanization of county, will further influence the overall urbanization process in China. Nearby urbanization meets farmers’ hope of complete urbanization. A shortcoming of remote urbanization is “semi-urbanization”. Rural migrant workers have experienced a change in living space and occupation and a nominal shift towards urbanization. However, they are not completely integrated into the city (Lu and Chen, 2015). A key requirement of the new-type urbanization is that the migrant population will be completely integrated into city living and become an ordinary part of the city population. Nearby urbanization will help farmers discard the awkwardness of “semi-urbanization” that they encounter in remote urbanization, as well as obtain urban resident status and secure non-agricultural employment close to their place of residence; as such, this arrangement fits well with farmer expectations for urbanization. Under this arrangement, farmers still live in the same area, and it is easy for them to reach consensuses because of similar thoughts and ideas as peer farmers. In turn, urban living concepts are fostered among farmers and the realization of “complete urbanization” is further facilitated.

People-oriented new-type urbanization places an emphasis on harmony and the sustainable development principle and focuses on addressing the issues created under the remote urbanization path (Liao, 2015). The new-type urbanization advocates the human idea of “you can still see the mountain, touch the water, and feel the nostalgia.” Towns serving as service centers and county seats are the main carriers of nearby urbanization, and they have unmatched advantages. Nearby urbanization will promote industry transformation and upgrade, as well as adding employment opportunities and increasing the actual income of rural residents while enabling them to enjoy many public services. In addition, small cities and towns have a livable environment and offer an appropriate pace of life that will not overwhelm farmers and that will attract residents from nearby cities (Zhou and Ma, 2003; Carr, 2009).
The new-type urbanization of county mainly refers to the urbanization of rural areas and connects the developments of urban and rural areas. China has reached an urbanization rate of 63.89%, but the rural population is still up to 510 million in 2020. These rural residents also should be able to share the results of China’s socioeconomic development, as well as enjoy higher-level education, health care, and other public services. Due to the vast physical space of rural areas, currently, high-level public services, such as education and health care, can be delivered only in county seats and central towns that serve as service centers (Chen et al., 2017). As such, the new-type urbanization of county plays an irreplaceable role in enhancing the development of vast rural areas and in meeting rural residents’ need for better lives.

Based on the above analyses, we propose a framework for analyzing the new-type urbanization of county (Figure 1). Through the comparison of the two theoretical modes of the new-type urbanization, we believe that the urbanization of county is a kind of nearby urbanization that addresses the deficiencies in remote urbanization and meets the realistic needs of rural areas in terms of economic development and urbanization. Therefore, the urbanization of county is an important component of the new-type urbanization in China and an important way to promote people-oriented new-type urbanization.

**Figure 1** Relationships among remote urbanization, nearby urbanization, and new-type urbanization of county

### 3 Data and method

This paper uses county-specific data collected during the fifth census in 2000 and the sixth census in 2010, as well as 2018 demographic information by county. The study uses data on the total permanent population and total urban permanent population to analyze the spatio-temporal patterns of the urbanization of county and county-level cities. The paper further examines the factors that influence the urbanization of county by considering the counties’ natural endowments and socioeconomic development.
Considering the particular characteristics of the process and driving forces of urbanization of county, as well as data availability, this paper sets the 2010 county urbanization rate as the dependent variable; selects 17 independent variables in relation to economic development level, ability of population agglomeration, social development level, and geographic location to construct a regression equation (Table 1); and analyzes the factors that significantly affect the urbanization level of counties, as well as the directions of the impacts.

| Category                | Independent variable | Description of independent variable                                      |
|-------------------------|----------------------|-------------------------------------------------------------------------|
| Economic development    | PGDP (thousand yuan) | Per capita gross domestic product                                         |
|                         | PVP (%)              | Proportion of the value added by the primary industry                    |
|                         | PVS (%)              | Proportion of the value added by the secondary industry                  |
|                         | PEM (%)              | Proportion of workers in the manufacturing industry                      |
|                         | PEPS (%)             | Proportion of workers in the producer services industry                  |
|                         | PECS (%)             | Proportion of workers in the consumer services industry                  |
|                         | IR (%)               | Income ratio of urban to rural residents                                 |
| Population agglomeration| MFP (%)              | Proportion of the population that migrated from outside the province     |
|                         | MFC (%)              | Proportion of the population that migrated from other counties of the province |
| Social development      | AYS (years)          | Average years of schooling                                               |
|                         | PHB (beds/person)    | Number of beds in hospitals and health centers                          |
| Location characteristics | DCC (km)            | Distance from county town to provincial capital                         |
|                         | DPC (km)            | Distance from county town to prefecture-level city center               |
|                         | DRS (km)            | Distance from county town to the nearest railway station               |
|                         | MA (m)              | Mean altitude                                                           |
|                         | MS (%)              | Mean slope                                                              |
|                         | WAI (%)             | Water abundance index (Li, 2009)                                        |

Urbanization is an inevitable result of economic development and the economic development level is a direct indicator that reflects the urbanization rate. The literature has extensively examined the correlation between urbanization and economic development (Henderson, 2003; Li et al., 2014). To further analyze the impact of different industries on the urbanization rate of counties, this paper selects the per capita gross domestic product (GDP), the proportion of the value added by the primary industry, the proportion of the value added by the secondary industry, the proportion of workers in the manufacturing industry, the proportion of workers in the producer services industry, the proportion of workers in the consumer services industry, and the income ratio of urban to rural residents as economic development indicators.

The ability to agglomerate population reflects a region’s inclusiveness and friendliness toward the outside population from one aspect (Chen et al., 2016); it has a demonstrative effect for further population agglomeration and affects the region’s urbanization level. This research selects the proportion of the total population that migrated from within and outside the province as the indicator.
A region with higher-level social development can provide better infrastructure and public services required by urbanization, as well as create more employment opportunities. As such, higher-level social development means a higher level of urbanization. This paper uses the average years of education and the per capita number of hospital beds to measure the impact of social development.

Natural endowments are the foundation of urbanization. Regions with superior geographic locations are in a better position to supply the variety of factors required by urbanization (Long et al., 2009; Liu et al., 2016). This paper uses the average altitude and water abundance index to describe each region’s natural, geographic, and locational conditions. Notably, the water abundance index is assigned to different counties based on Li Jiuyi’s study on water resource shortage, risk assessment, and management countermeasures in China, and values are assigned to different counties (Li, 2009). In addition, the distances to the city centers of provincial capital and prefecture-level cities and to arterial transportation routes also are included as indicators. Generally, regions closer to main railways have better socioeconomic conditions and higher urbanization rates. On the one hand, cities close to provincial capitals or prefecture-level cities are more closely affected by these cities and typically have a higher urbanization rate; on the other hand, due to the siphon effect and polarization effect caused by the developed regions, counties may have to face the exodus of population, resources, and technology (Getis and Ord, 1992).

4 Spatio-temporal patterns of urbanization of county

At the end of 2018, there were 2851 county-level jurisdictions, including 970 municipal districts, 375 county-level cities, 1335 counties, and 117 autonomous counties (NBS C, 2019). This paper will focus on the 1881 county-level jurisdictions after exclusion of the districts under prefecture-level cities (abbreviated to counties hereafter). These jurisdictions account for 95.63% of China’s land area, and at the end of 2018, the total population was 803 million, accounting for 57.53% of the country’s total.

Between 2000 and 2010, the total population of the counties decreased, but the urban population of these jurisdictions increased, indicating that the urbanization rate was rapidly growing. However, compared with the national average, the urbanization rate for counties was still low, and the potential for urbanization was significant. In 2000, the total population of the counties was 788.2968 million, accounting for 62.20% of the national population; the urban population of counties was 172.5417 million, accounting for 37.59% of the total urban population in China. The urbanization rate of these counties was 21.89%, which was lower than the national average of 36.22%. In 2010, the total county population was 785.7342 million, accounting for 58.60% of the national population; the urban population of counties was 274.217 million, accounting for 40.94% of the total urban population in China. The urbanization rate of counties was 34.90%, which was lower than the national average of 49.95%.

4.1 Spatio-temporal development pattern of urbanization of county

From 2000 to 2010, the urbanization level in counties in China continued to grow, increasing from 21.89% in 2000 to 34.90% in 2010. The total number of counties that had an urbanization rate below 20% rapidly decreased, from 1047 in 2000 to 269 in 2010; the proportion of these counties accounted for decreased from 55.66% to 14.30% (Table 2). The number of
counties with an urbanization rate between 30% and 50% saw the most significant increase, from 313 in 2000 to 879 in 2010; the proportion these counties accounted for increased from 16.64% to 47.73%.

### Table 2  Proportion of different degrees of urbanization at county level in China in 2000 and 2010

| Urbanization rate (%) | China | East of Hu Line | West of Hu Line |
|-----------------------|-------|-----------------|-----------------|
|                       | 2000  | 2010 | Change rate (%) | 2000  | 2010 | Change rate (%) | 2000  | 2010 | Change rate (%) |
| <20                   | 1047  | 269  | -41.36         | 711   | 103  | -45.82         | 336   | 166  | -30.69         |
| 20–30                 | 427   | 532  | 5.58           | 308   | 394  | 6.48           | 119   | 138  | 3.43           |
| 30–50                 | 313   | 879  | 30.09          | 251   | 695  | 33.46          | 62    | 184  | 22.02          |
| 50–70                 | 61    | 153  | 4.89           | 42    | 115  | 5.50           | 19    | 38   | 3.43           |
| >70                   | 33    | 48   | 0.80           | 15    | 20   | 0.38           | 18    | 28   | 1.81           |

Using the “Heihe-Tengchong Line” (hereafter referred to as the “Hu Line”) as the dividing boundary, the east-west disparity in urbanization is evident. Counties with a medium urbanization rate of 30%–50% dominate the east of the “Hu Line” in 2010 and account for 52.37% of all counties; west of the “Hu Line,” there are equal numbers of counties with a medium urbanization rate of 30%–50%, low urbanization rate of 20%–30%, and extremely low urbanization rate of below 20%, with each group accounting for approximately 30% of the total number of counties.

In terms of the spatial distribution, counties along the east coast, especially those in the coastal regions of the provinces of Shandong, Jiangsu, Zhejiang, Fujian, and Guangdong, have a higher urbanization level (Figure 2). Notably, due to the special arrangements for the administrative districts in regions close to the country’s borders or in forest regions, the three provinces in the northeast and the Inner Mongolia Autonomous Region have several counties with high urbanization rates. For instance, Manzhouli of Inner Mongolia is China’s largest city with a land border crossing. The land area is only 453 square kilometers and nearly the entire population is an urban population. Fenglin and Daqingshan counties of Yichun, a prefecture-level municipality of Heilongjiang Province, are classified as forest districts. Their populations also are concentrated in the county seats or the built-up areas of

![Figure 2](image-url)  Regional differences in urbanization rates of China’s counties in 2000 (a) and 2010 (b)
incorporated towns. In comparison with the year 2000, most counties in the eastern and central regions have seen significant improvements in their urbanization rates. Only a small number of counties still have an urbanization rate below 30%. Counties with an urbanization rate below 20% are mainly located in Qinghai Province, the Tibet Autonomous Region, the south side of the Xinjiang Uygur Autonomous Region, and parts of Yunnan and Gansu provinces.

4.2 Spatio-temporal patterns of urban populations in counties

Divided by the “Hu Line,” there is more population in the southeastern half of the country and less in the northwestern half. In 2018, the total county population east of the “Hu Line” was 688 million, accounting for 85.67% of the total county population in China; the total county population west of the “Hu Line” was 115 million, accounting for only 14.33% of the total county population. In comparison with the total population distribution, the county population west of the “Hu Line” accounted for a higher proportion of China’s total county population. Counties with a large population are mainly located in the southeastern coastal provinces, such as Fujian, Guangdong, Jiangsu, and Zhejiang (Figure 3). For instance, the total 2018 populations of Jinyang in Fujian Province and Puning in Guangdong Province exceeded 2 million. Counties with a small population were mainly located in Inner Mongolia, east Xinjiang, Qinghai, and Tibet. For instance, the population of Zanda and Rutog counties in Tibet was only approximately 10,000.

Figure 3 Spatial patterns of total population in China’s counties in 2018

Counties east of the “Hu Line” tend to have large populations. In this region, counties with populations of 200,000–400,000 or 400,000–700,000 account for 63% of all counties; counties with populations less than 200,000 only account for 11.83% of the counties, while those with populations greater than 700,000 account for approximately 24%. Counties with
small to medium-sized populations dominate the region west of the “Hu Line.” Counties with populations of 0–200,000 or 200,000–400,000 account for 86.28% of all counties in this region, while counties with a population above 700,000 account for only 1.80% (Figure 4).

In terms of growth, the county population on the east side of the “Hu Line” demonstrates a general declining trend, while this trend in the northeast is localized (Figure 5). Between 2000 and 2010, 821 counties experienced a population decrease, accounting for 43.65% of all counties. Due to the siphon effect of large cities, there is a significant population outflow from counties east of the “Hu Line”. The counties that have experienced a population decrease account for 48.38% of all counties in the eastern region. However, on the west side of the “Hu Line”, the population is generally growing. In this decade, counties that experienced a population growth of less than 100,000 accounted for 65.88% of all the counties on the west of the “Hu Line”. Between 2010 and 2018, 396 counties experienced a decrease in their total population, accounting for 21.05% of all counties. Nationwide, population growth was the main trend for counties, with those that experienced an increase accounting for 78.95% of all counties across the nation. Counties that experienced a population decrease formed contiguous patches in Heilongjiang, Jilin, and Liaoning. Certain counties in the central and western provinces, such as Henan, Guizhou, and Shaanxi, also had population decreases.

The imbalance that characterizes the total population distribution at the county level, more population in the southeast and less population in the northwest, is more prominent in regard to the urban population distribution at the county level; moreover, urban population
growth at the county level is faster in the southeast than in the northwest. In 2010, the total urban population at the county level east of the “Hu Line” was 239 million, accounting for 87.27% of the total urban population of counties nationwide; the total urban population at the county level west of the “Hu Line” was 35 million, accounting for only 12.73% of the total urban population of counties nationwide. In terms of the growth rate, between 2000 and 2010, the urban population growth rate at the county level in the southeast half of China was 59.66%, higher than the 54.05% rate in the northwest half. In terms of growth distribution, counties with high population growth are mainly located along the southeast coast and the Yangtze River economic zones, such as Jinjiang in Fujian, Jiangyin and Kunshan in Jiangsu, Rui’an in Zhejiang, and Ningxiang in Hunan (Figure 6). Over 10 years, these counties had a population increase of more than 400,000. Counties with low population growth rates are mainly in regions, such as Tibet and Xinjiang. The imbalance in the urban population distribution in the future will be even more significant.

![Figure 6](image)

We divide the urban population sizes into five levels (Figure 7) to analyze the disparity in the distribution of urban population on either side of the “Hu Line”. The figure indicates that the population sizes east of the “Hu Line” change from a pot shape to a spindle shape, while the distribution of population sizes west of the line always shows a pyramid shape. However, the difference in sizes gradually decreases. East of the “Hu Line”, the counties with populations of 50,000–100,000 and 100,000–300,000 increased from 64.88% of all counties in 2000 to 76.65% in 2010; the proportion of counties with a population less than 50,000 dramatically decreased from 29.39% in 2000 to 9.42% in 2010, while the proportion of counties with a population of 300,000–500,000 increased by 6 percentage points. The overall distribution shifted from a pot shape, indicating the distribution was relatively balanced, to a spindle shape with both ends larger than the middle part. West of the “Hu Line”, the proportion of counties with populations of 0–50,000 or 50,000–100,000 decreased from 90.07% in 2000 to 80.51% in 2010; the proportion of counties with populations of 100,000–300,000 or 300,000–500,000 increased by 9.57%, indicating that counties west of the “Hu Line” will see their populations grow to 100,000–300,000 or more.
Figure 7  The hierarchical size structure of urban population in China’s counties in 2000 and 2010

4.3 Development types of urbanization of county

This paper applies the urbanization rate and the urbanization growth rate to sort county urbanization types into four quadrants. The urbanization rate is plotted on the x-axis, and the growth rate is plotted on the y-axis. The average urbanization rate of counties in 2010, which was 34.9%, and the average growth rate between 2000 and 2010, which was 5.32%, are used as thresholds; as such, a point (34.9, 5.32) is set as the origin to draw a coordinate system. So, the urbanization of county is sorted into four types: high urbanization rate-high urbanization growth rate (the first quadrant), low urbanization rate-high urbanization growth rate (the second quadrant), low urbanization rate-low urbanization growth rate (the third quadrant), and high urbanization rate-low urbanization growth rate (the fourth quadrant).

Of the 1,881 counties in China, 637 belong to the low urbanization rate-high urbanization growth rate category; this type accounts for the largest proportion at 33.86% (Table 3). This type is followed by the low urbanization rate-low urbanization growth rate category, which contains 478 counties, accounting for 25.41% of all counties. The third category is the high urbanization rate-low growth rate type, which has 452 counties and accounts for 24.03% of all counties, and the last category is the high urbanization rate-low urbanization growth rate type, which has only 314 counties, accounting for 16.69% of all counties, less than half the share of the low urbanization rate-high growth rate category.

Table 3  Proportion of different types of county urbanization development in China in 2010

| Quadrant     | County urbanization types             | Number | Proportion (%) |
|--------------|---------------------------------------|--------|---------------|
| Quadrant I   | High urbanization rate-rapid type      | 314    | 16.69         |
| Quadrant II  | Low urbanization rate-rapid type       | 637    | 33.86         |
| Quadrant III | Low urbanization rate-slow type        | 478    | 25.41         |
| Quadrant IV  | High urbanization rate-slow type       | 452    | 24.03         |

Counties in the high urbanization rate-high growth rate category are mainly located in the regions along the southeast coast or along the Yangtze River, including Hebei, Zhejiang,
Jiangsu, Hunan, and Hubei (Figure 8); these counties realized rapid urbanization thanks to the rapid development of the province and core cities. Counties in the high urbanization rate-low growth rate category are mainly in the provinces of the southeast or northeast, including Fujian, Guangdong, Heilongjiang, Jilin, and Liaoning. Notably, this category also includes a few counties in Inner Mongolia because the unique natural and geographic conditions of this region dictate that most of the population would be located in urban areas. Multiple cities in this region, such as Hohhot, Ordos, and Baotou, have the foundation needed to achieve a high urbanization rate. Due to the early start in industrialization, the northeast provinces also have the foundation needed to steadily increase their urbanization rate (Lin et al., 2018).

The low urbanization rate-high growth rate category has the most counties, which are always located in central provinces including Gansu, Shaanxi, Guizhou, Sichuan, and Henan; these counties cover the majority of areas excluding the “T-shaped” development area. Counties in the low urbanization rate-low growth rate category are mainly located in the western region, including Qinghai, Tibet, Xinjiang, Yunnan, and Guizhou. The natural environment of these regions is harsh, and economic development lags. This type of county is also sporadically distributed in provinces, including Anhui, Henan, Shaanxi, and Hebei; this type is mainly located at the exterior portion of a province or along the provincial borders where development is weak.

4.4 Factors that influence urbanization of county

A multiple regression analysis is performed to examine the spatial factors that influenced the 2010 urbanization rates of counties (Table 4). The model’s goodness of fit is 72.9%, and the significance level is less than 5%, indicating that the linear relationship between the dependent variable and independent variables is significant. As there are up to 17 independent factors including...
variables in the model and to avoid multi-collinearity, a tolerance and variance inflation factor (VIF) test is performed. The results show that the VIFs of all 17 independent variables are all less than 5 and that the tolerance is less than 1, indicating that the model does not have multi-collinearity.

Table 4  Regression analysis results of county urbanization development

| Variable | Coefficient | Beta | t   | Sig. | Tolerance | VIF |
|----------|-------------|------|-----|------|-----------|-----|
| Constant | –3.855      | –1.165 | 0.244 |      |           |     |
| PGDP     | 0.096***    | 0.132 | 5.695 | 0.000 | 0.331     | 3.017|
| PVP      | –0.026      | –0.027 | –1.229 | 0.219 | 0.381     | 2.627|
| PVS      | 0.010*      | 0.064 | 1.900 | 0.058 | 0.160     | 6.258|
| PEM      | 0.159***    | 0.125 | 6.303 | 0.000 | 0.453     | 2.207|
| PEPS     | 1.163***    | 0.206 | 8.593 | 0.000 | 0.310     | 3.227|
| PECS     | 0.609***    | 0.239 | 10.004 | 0.000 | 0.313     | 3.194|
| IR       | –0.002***   | –0.060 | –3.270 | 0.001 | 0.522     | 1.918|
| MFP      | 0.350***    | 0.221 | 10.112 | 0.000 | 0.375     | 2.670|
| MFC      | 0.023***    | 0.123 | 5.663 | 0.000 | 0.276     | 3.732|
| AYS      | 1.862***    | 0.135 | 6.273 | 0.000 | 0.385     | 2.598|
| PHB      | 0.002***    | 0.130 | 5.785 | 0.000 | 0.354     | 2.825|
| DCC      | –3.315E-5   | 0.000 | –0.025 | 0.980 | 0.633     | 1.580|
| DPC      | –0.016***   | –0.055 | –3.143 | 0.002 | 0.586     | 1.707|
| DRS      | 0.001***    | 0.056 | 2.761 | 0.006 | 0.435     | 2.300|
| MA       | –0.001**    | –0.049 | –2.188 | 0.029 | 0.351     | 2.847|
| MS       | –0.023**    | –0.056 | –2.764 | 0.037 | 0.267     | 3.792|
| WAI      | 0.051***    | 0.059 | 3.129 | 0.002 | 0.496     | 2.016|

R² 0.729
Adjusted R² 0.726
F 240.333
Sig. 0.000
DW 1.949
Observations 1534

Note: *** denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

The regression analysis indicates that the economic development level, the ability to agglomerate population, the social development level, and the geographic and locational characteristics all have a significant impact on the urbanization rate of counties. Based on the test results, other than the proportion of the value added by the primary industry and distance to the provincial capital, which do not pass the significance test, the other 15 variables all have a significant impact on the county urbanization rate.

In terms of economic development, economic growth and the transformation and upgrade of the industry structure are the main forces that drive the urbanization of county, while the urban-rural disparity in income will hamper the growth of the urbanization rate. The regression coefficient of the per capital GDP is positive and significant, indicating that economic growth is the direct driving force of urbanization of county. The regression coefficients of
the proportion of workers in the manufacturing industry, the proportion of workers in the producer services industry, and the proportion of workers in the consumer services industry are all positive and significant, indicating that a non-agricultural, upgraded industrial structure is a necessity for urbanization. With a larger county population working in manufacturing and service industries, urbanization of the county will experience a positive boost (Wang and Li, 2016; Liu et al., 2017; Li et al., 2019). The regression coefficient of the income disparity between urban and rural areas is negative and significant, indicating that an imbalance in regional economic development will hamper the urbanization process.

In terms of population and social development, the level of basic public services drives the urbanization of county. The average years of education and the total number of hospital beds all have a positive and significant regression coefficient, indicating that the imbalance between the vast county areas and developed regions is mainly embodied by the disparity in public services, which is an evident weak area in the urbanization process of counties. Therefore, public services, such as education and health care, are among the determinants that affect county urbanization rates. The ability to agglomerate a population also has a positive impact on urbanization. With increasing population mobility, the contributions made by the inflowing population should not be neglected. Inclusiveness and friendliness toward the inflowing population will enhance the county urbanization process.

In terms of geographic locations, natural and geographic conditions and distances to core regional cities have a fundamental impact on urbanization of county. The regression coefficient of the average altitude is negative, the coefficient of the water abundance index is positive, and both are significant, indicating that plains with low altitudes and abundant water resources can better provide the basic factors needed for urbanization. The regression coefficients of the distances to the provincial capital and the prefecture-level municipality are negative, and the latter has a more significant impact, indicating that to a large extent, prefecture-level cities drive urbanization of county instead of negatively affecting it through the polarization effect.

5 Discussion

5.1 People-oriented new-type urbanization should consider two important modes: remote urbanization and nearby urbanization

Whether the off-farm labor force moves to large cities far away from their hometown or flows to the small and medium-sized cities and towns near their hometown can be viewed as a micro choice based on personal values under the background of the macro economy (Xu, 1984). The rural labor force that intends to realize urbanization near their hometown are mainly middle-aged and elder workers, who are used to a society of acquaintances and a lifestyle in the countryside. The rural labor force that prefers remote urbanization is dominated by new-generation rural workers, who have a strong ability to adapt to urban life and eagerly pursue public services and infrastructure (Hare, 1999; Ma, 2002). When the micro personal choice is reflected in the macro modes of urbanization, both remote urbanization and nearby urbanization are needed. Under the requirement of high-quality urbanization, remote urbanization, which is currently the mainstream of urbanization, is facing the tremendous task of granting permanent urban residency to the mobile population. Nearby ur-
urbanization has demonstrated better adaptability and is an important mode for promoting people-oriented new-type urbanization.

5.2 The urbanization of county is the main form of nearby urbanization, an important supplement to the remote urbanization dominated by large city clusters, and a critical component of high-quality development in the central and western regions in the future

Remote urbanization has dominated the traditional urbanization process. In this process, surplus rural workers in the vast underdeveloped areas of the central and western regions move to large cities on the east coast. As a result, the cities receiving the migrant labor force face significant pressures on their resources, and the “big-city disease” becomes a prominent issue. Cities expand their frontiers in an unorderly way, and migrant workers have difficulties integrating into the local society and culture. The source regions of the migrant labor force are challenged with the issues of “hollowed villages” and a large group of people being left-behind. These issues seriously restrain the level of socioeconomic development and urbanization upgrade. Under the background of the new-type urbanization, county-based nearby urbanization has evident advantages and acts as an important supplement to the remote urbanization dominated by city clusters and large cities; this component should be a critical step in enhancing the quality of urbanization in the central and western regions in the future. Urbanization of county will accelerate industrial development, boost demand, improve the consumption environment, and provide employment opportunities for rural workers close to their homes. Furthermore, urbanization of county will strengthen infrastructure development, improve public services and social security, and enable residents to enjoy a living environment comparable to that in larger cities without leaving their original place of residence. Urbanization of county also helps to conserve and inherit rural culture and realize sustainable socioeconomic development.

5.3 Urbanization of county should capitalize on local advantages, enhance development of specialized industries unique to the county, and strengthen the development of public infrastructure

For off-farm rural workers, higher income, better public services, and whether they can adapt to urban living are important factors that determine whether they can realize nearby urbanization. In this research, the economic development level, ability to agglomerate the population, social development level, government administrative ability, and geographic and locational attributes all have significant impacts on the urbanization rate. In the future, these factors will largely shape the urbanization patterns of counties. In the new era, the advancement of urbanization still needs to utilize the driving forces of economic development, optimization of industrial structures, and coordinated development between urban and rural areas. More efforts should also be put into public services and social security, infrastructure development, and improving the ability to agglomerate inflowing population. Sufficient focus should be placed on the driving effect of the geographic and locational factors, and the systemic feedback from factors, such as resources and the environment. Specifically, urbanization of county should build on industrial development; attach more significance to the transformation and upgrade of the manufacturing sector, as well as its ability to provide em-
employment opportunities; enhance the coordinated development of the producer service industries and the consumer service industries, create an employment environment, living environment, and institutional environment that will help with population mobility and agglomeration; capitalize on locational advantages and develop industries that utilize local endowments; and enhance the intensity and efficiency of land use.

5.4 The new-type urbanization mode that integrates remote urbanization and nearby urbanization provides an example of urbanization for developing countries worldwide

China’s urbanization is regarded as one of two top events that have affected the development of human society in the 21st century. The new-type urbanization mode that integrates remote urbanization and nearby urbanization provides an urbanization example for developing countries across the globe. The report to the 19th National Congress of the Communist Party of China states that China will “create networks of cities and towns based on city clusters, enabling the coordinated development of cities of different sizes and small towns, and speed up work on granting permanent urban residency to people who move from rural to urban areas.” This policy directive indicates that China’s urbanization has entered a new phase, where the “quantity-centered” expansion is shifting to “quality-centered” upgrade, and the people-oriented, new-type urbanization approach has become the necessary choice. Given China’s unique dual urban-rural structure and the fact that a tremendous rural population has existed for a long time, the path to urbanization has also shown a characteristic of duality. County-based nearby urbanization is rapidly progressing and will demonstrate its significance in the national and global urbanization process.

6 Conclusions

The analysis of two theoretical models of new-type urbanization shows the importance of nearby urbanization, and the urbanization of county and the development of county seat as an important way of nearby urbanization are of great significance. This paper takes counties and county-level cities as the objects of study and uses the fifth and sixth census data and the 2018 demographic statistics to analyze the spatio-temporal evolution of the urbanization of county in China, as well as the factors that influence the evolution. The main conclusions are described as follows: Urbanization of county is lower than the average level of urbanization across China and is a weak area in overall urbanization. Therefore, county is an important space for enhancing China’s urbanization in the future. The imbalance of the urban population distribution at the county level is more prominent than that of the total population distribution. Urban population growth at the county level is faster in the southeast than in the northwest, and high-growth areas are mainly concentrated along the southeast coast and the Yangtze River economic zones. From 2000 to 2010, the urbanization level of counties significantly improved, and the spatial patterns remained stable. Counties with high-level urbanization were concentrated in the coastal areas in the eastern region; counties that experienced rapid urbanization were mainly located in the central region and a number of provinces in the western region. Regression analyses indicate that the economic development level, ability to agglomerate the population, the social development level, the government’s administrative
ability, and the geographic and locational attributes all have significant impacts on the urbanization rate. Inferior natural endowments that constrain economic development are the most important factors hindering urbanization of county; these factors include marginalized locations far away from center cities, high altitudes, and a population with a low education level.

China’s new-type urbanization of county is still in the initial stage of quality improvement. On the one hand, the urbanization rate of counties significantly lags behind the overall national urbanization rate. On the other hand, the public services and infrastructure in counties are still relatively underdeveloped, especially the shortfalls in health services exposed in the COVID-19 epidemic. Increasing the urbanization level of counties will be the major area of focus in China’s new-type urbanization in the future. Urbanization of county avoids the issues caused by remote urbanization; it also promotes urban-rural integration, drives rural development and revitalization, and provides an example for the urbanization of developing countries.

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