Chapter 5
Space-Time Analysis and Factors Attribution of Urban Shrinkage in Northeast China

Jiahui Fan

Abstract Northeast China has been involved in urban shrinkage, or a decline in the economy and the population in recent years. This paper used population data to identify shrinking cities, analyzed the space-time distribution of urban shrinkage in Northeast China, and then attempted to identify influencing factors. The space-time distribution of the urban shrinkage was measured at the prefecture and district–county levels using data from 2000, 2008, 2010, and 2016. During 2000–2010, nearly 1/3 of prefecture-level units and 1/2 of district–county units experienced urban shrinkage. Moreover, during 2008–2016, the data increased to nearly 8/9 and 3/4. The phenomenon of urban shrinkage is becoming increasingly common in Northeast China. Several significant agglomeration areas have been formed in Daxinganling, Yichun-Heihe, Jiamusi, and Jixi-Qitaihe-Mudanjiang-Yanbian. On the whole, the shrinking areas are expanding. The phenomenon is obvious, particularly in Heilongjiang Province. This paper uses quantitative and qualitative methods to identify influencing factors from regional economic disparities, urbanization processes, industrial structure changes, population structure changes, and administrative division adjustments. The results showed that the secondary and tertiary industrial structure changes and administrative division adjustments had the strongest relevance to urban shrinkage in Northeast China and that this urban shrinkage was mainly influenced by the second industry atrophy caused by the "deindustrialization" of this time. At the same time, the adjustment of regional divisions in Northeast China objectively led to substantial changes in population statistics, which caused population shrinkage in some areas. Urban shrinkage is a process of objective development and an unavoidable and diachronic issue in many cities. The process is complex, and the population changes and economic vitality, in particular, represent a mutual cause-and-effect phenomenon that requires more in-depth research.

Keywords Northeast China · Urban shrinkage · Space-time analysis · Factors

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5.1 Introduction

Since the middle of the twentieth century, some western cities have gradually experienced urban shrinkage, or a decline in the economy and the population. Between 1990 and 2010, more than one quarter of the urban population throughout the world was in decline, approximately 40% of the European urban population also declined, 10% of American cities were shrinking, and population losses in small- and medium-sized cities in Japan, South Korea, and South Africa were common (Wu et al. 2015). In addition to western developed countries, some scholars found that 26.71% of prefecture-level units and 37.16% of district–county units in China were shrinking, and the phenomenon in Northeast China and the Yangtze River Economic Belt were most evident (Zhang et al. 2016).

The concept of a "shrinking city" was first proposed in 1977 by the German scholar Göb, who discovered a trend in large cities in West Germany of the population constantly relocating to small and medium-sized cities (Göb 1977). Subsequently, in 1988, German scholars Häußermann and Siebel began to study shrinking cities from a sociological view, increasing the attention paid to the topic (Häußermann and Siebel 1988). Until 1998, shrinking cities were used to describe hollowed-out inner cities that lost a significant part of their population from suburbanization (Howe et al. 1998). Then, urban scholars began to frequently use the term (Gao 2017). Urban shrinkage usually refers to a densely populated area facing serious population loss and a structural economic crisis (Pallagst 2008). However, urban shrinkage is usually accompanied by a multidimensional decline in geography, society, and space (Martinez-Fernandez et al. 2012). Some scholars concluded that narrow urban shrinkage referred to the continuous loss of population in a region and, in a broad sense, referred to a decline in population, economy, society, environment, culture, and space (Xu and Pang 2014). Shrinking City International Research Network defined urban shrinkage as "a densely populated urban area with more than 10,000 population, facing population loss for more than 2 years and experiencing structural economic crisis" (Yang and Yin 2013).

In recent years, domestic scholars began to pay attention to the phenomenon of urban shrinkage. Wu kang and others used two sets of census data, from 2000 and 2010, to investigate the urban shrinkage in the Beijing–Tianjin–Hebei area and the Yangtze River Delta, and identify some influencing factors (Wu et al. 2015). Li Wei and others examined the spatial distribution of urban shrinkage and analyzed the urban shrinkage characteristics and mechanism in the Pearl River Delta (Li et al. 2015). Zhao Dan and others took Sheyang County in Jiangsu Province as an example of an analysis of the common characteristics and development difficulties of urban shrinkage in competitive regions (Zhao and Zhang 2018). Liu Jin and others analyzed the external features and internal mechanisms of population shrinkage in Maoming City in Guangdong Province—an area in the process of rapid urbanization—and proposed the concept of "hard shrinkage," which is the outflow of the agricultural population (Jin and Chunfeng 2018). In addition to the research on developed regions, the study on urban shrinkage in Northeast China has gradually increased in recent

years. Gao Shuqi and others identified and analyzed shrinking cities in Northeast China from 2000 to 2010 and selected Yichun City in Heilongjiang Province—with noticeable shrinkage—as a case study (Gao and Long 2017). Ma Jian conducted a study on the characteristics, trends, and influencing factors of urban shrinkage in Liaoning Province from 2010 to 2014 (Ma 2016). Li Yuanwei studied the status and formation mechanism of urban shrinkage in Jilin Province from 2000 to 2010 (Li 2016). It is worth noting that urban shrinkage is a population change phenomenon in a city over a certain period. Therefore, choosing the period to study is questionable. Current research on Northeast China mainly focuses on the 2000–2010 period—long in the past—making it necessary to study urban shrinkage in Northeast China in recent years.

Northeast China, which contains Heilongjiang Province, Jilin Province, and Liaoning Province, is a geographical and economic region of China and was once "the oldest son of the Republic." Today, under the background of capacity reduction and economic restructuring, urban shrinkage in Northeast China, which is characterized by economic and population decline, attracts significant attention. According to preliminary calculations by the National Development and Reform Commission, excluding the influences of natural growth, the migration out of Northeast China from 2010 to 2015 was approximately 240,000. As shown in Fig. 5.1, during 1990–2000, the population in Northeast China had relatively high growth. However, since 2000, the population growth has fluctuated and the growth rate has declined. Since 2010, the population growth rate has continuously declined, and even dropped to 0.00% in 2014. The changes in GDP in Northeast China from 1990 to 2015 (Fig. 5.2) indicate that, since 2008, economic growth has slowed and decreased sharply since 2011, at only 1.1% in 2015. Taking into account the population and economic changes in Northeast China in recent years, this paper mainly analyzed the spatial distribution characteristics of urban shrinkage during 2000–2010 and 2008–2016, to recognize the space-time evolution of urban shrinkage in Northeast China, further identify the influencing factors, and to attempt to analyze the mechanism.

5.2 Research Data and Indicators

5.2.1 Research Data

The research objects of urban shrinkage in Northeast China are at two levels. The research object at the prefecture level contains 36 prefecture-level units, and the research object at the district–county-level contains 295 district–county units. This paper used data on permanent residence and household registrations from the fifth and sixth national population census for 2000–2010 and data on the household registration population from statistical yearbooks for 2008–2016.

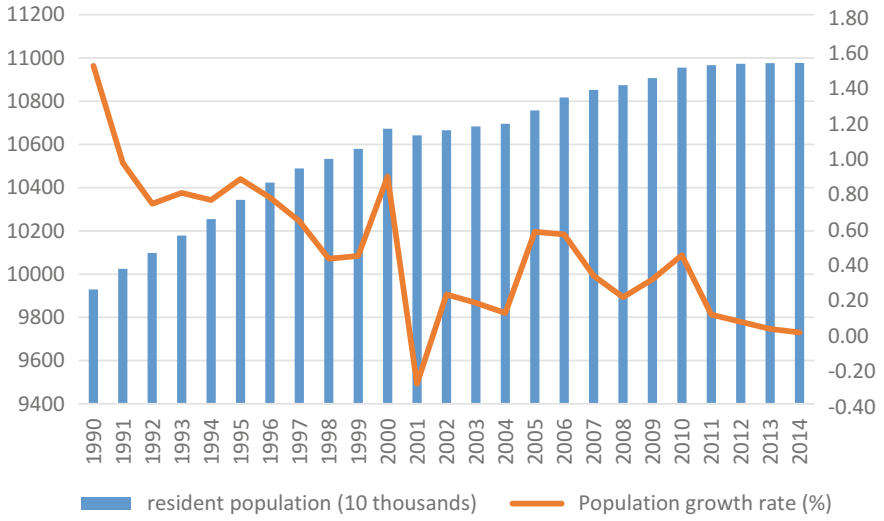

Fig. 5.1 Total population change in Northeast China from 1990 to 2014. *Sources* China Statistical Yearbook 2001–2015, China Population and Employment Statistics Yearbook 1990–2000

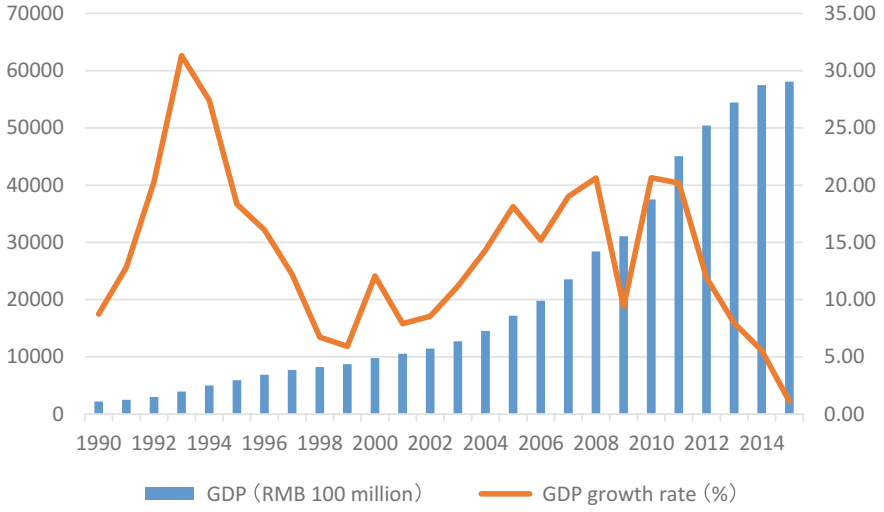

Fig. 5.2 Total GDP change in Northeast China from 1990 to 2015. *Sources* China Statistical Yearbook 1990–2015, Fifty-year Statistical Data Collection of China, Progress Database of the National Bureau of Statistics

5.2.2 Indicators

At present, the definition of shrinking cities is inconclusive. Most scholars use population reduction as a criterion for judging shrinking cities, but the specific criteria for defining the time span of continuous population reduction and total population reduction are also inconclusive (Gao 2017). Through a comprehensive consideration of domestic and foreign urban shrinkage discriminant indicators and combining the actual situation of population change in Northeast China, this study defines the shrinking cities in Northeast China as follows: during a certain period longer than 5 years, the annual population growth rate R is negative. Population data are selected at two time points to calculate the average annual population growth rate R. The formula is

$$R = \left[\left(\frac{p_2}{p_1} \right)^{\left(\frac{1}{n}\right)} - 1 \right] \times 100\%$$

The formula for calculating R is transformed from the formula, $p_2 = p_1 \times (1+R)^n$, where R is the average annual population growth rate; P_2 and P_1 are population data for 2 years, with P_2 being the prior year and P_1 being the following year, and n is the period of 2 years.

The discrimination of the annual population growth rate R is divided into six categories: obvious growth ($R > 1\%$), general growth ($0.5\% < R < 1\%$), weak growth ($0 < R < 0.5\%$), weak shrinkage ($-0.5\% < R < 0$), general shrinkage ($-1\% < R < -0.5\%$), and noticeable shrinkage ($R < -1\%$).

5.3 Space-Time Analysis of Urban Shrinkage in Northeast China

5.3.1 Space Distribution of Urban Shrinkage in Northeast China During 2000–2010

Census data from 2000 and 2010 were used to examine the urban shrinkage of prefecture-level and district–county units in Northeast China. Due to the adjustment of administrative divisions in some cities, this study matched and amended the population data on the 295 district–county units in 2000 based on the administrative boundary boundaries in 2010.

As shown in Fig. 5.3, from the perspective of permanent residents, 11 out of the 36 prefecture-level units in Northeast China were experiencing shrinkage. Among them, only Liaoyuan City, Fushun City, and Yichun City were in general shrinkage. Hegang City, Qiqihar City, Jixi City, Jilin City, Baishan City, Tieling City, Fuxin City, and Chaoyang City were in weak shrinkage and mainly distributed in the adjacent edges

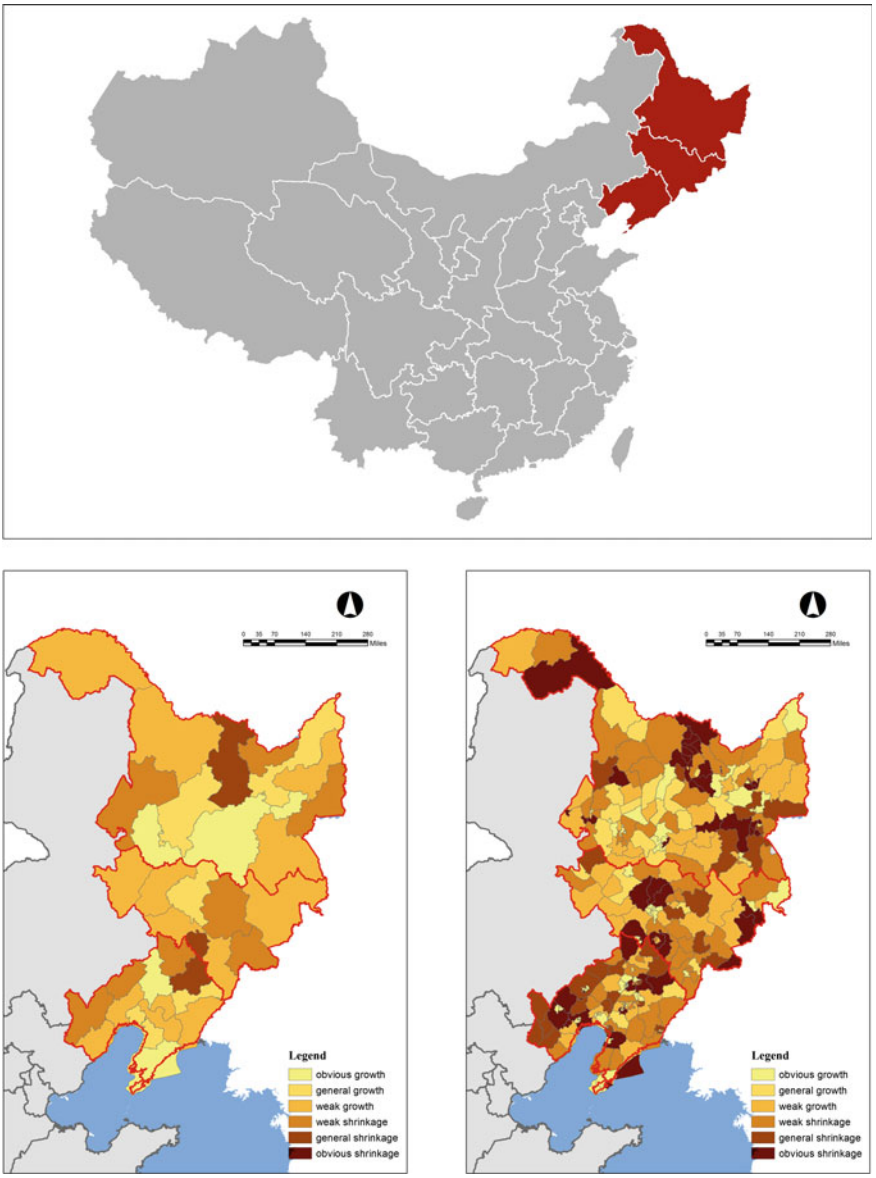

Fig. 5.3 Average annual growth rate of permanent residents in prefecture-level units (down left) and district–county units (down right) in Northeast China during 2000–2010

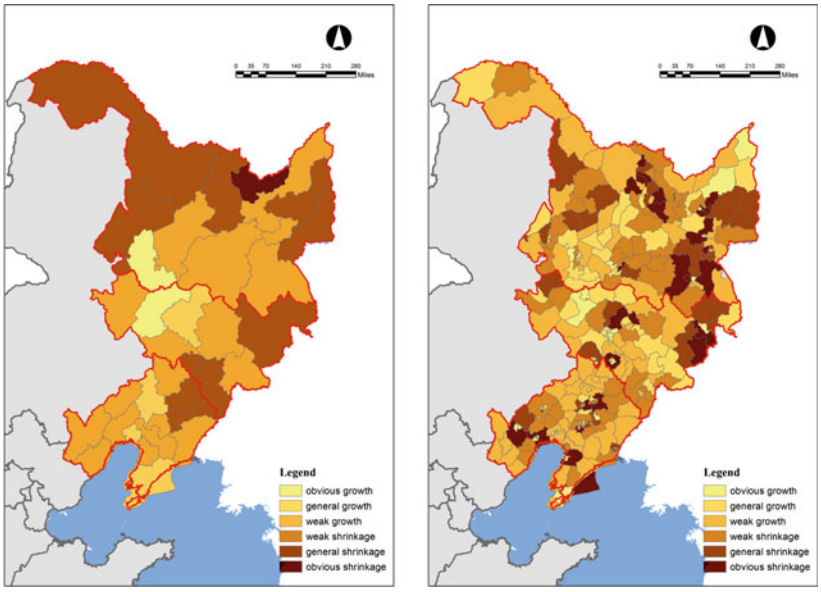

Fig. 5.4 Average annual growth rate of the household registration population in prefecture-level units (left) and district–county units (right) in Northeast China during 2000–2010. *Source* Drawn by the author

of and outside Northeast China. In the 295 district–county units in Northeast China, 146 units were in shrinkage, accounting for 49.5% of the total. In other words, nearly half of the cities experienced different levels of negative population growth. Among them, 55 district–county units were in noticeable shrinkage, accounting for 37.7% of the total shrinking cities. Shrinking cities in Northeast China appear to be common, and there were some characteristics in spatial distribution. Most of the shrinking areas focused on the border to the outside, and several agglomeration areas formed in the space, such as Yichun, Mudanjiang, Liaoyuan-Fushun, and Fuxin-Chaoyang. Other areas were mainly in local shrinkage and distributed discretely in space.

According to the household registration population, as shown in Fig. 5.4, there were 12 prefecture-level units experiencing shrinkage, and most of them were distributed in northern Heilongjiang Province. These areas are mostly restricted areas of development, such as mountainous areas and virgin forests. The climate is cold, which may be the reason for the negative growth in the household registration population. Compared with permanent residents, there were fewer shrinking cities in district–county level, with 132 units experiencing shrinkage and only 34 district—county units experiencing noticeable shrinkage. The spatial distribution was more dispersed. Except for the Mudanjiang area, the phenomenon of urban shrinkage in other areas was weaker relative to permanent residents. This finding indicates that the decrease in the household registration population in the Mudanjiang area was very evident.

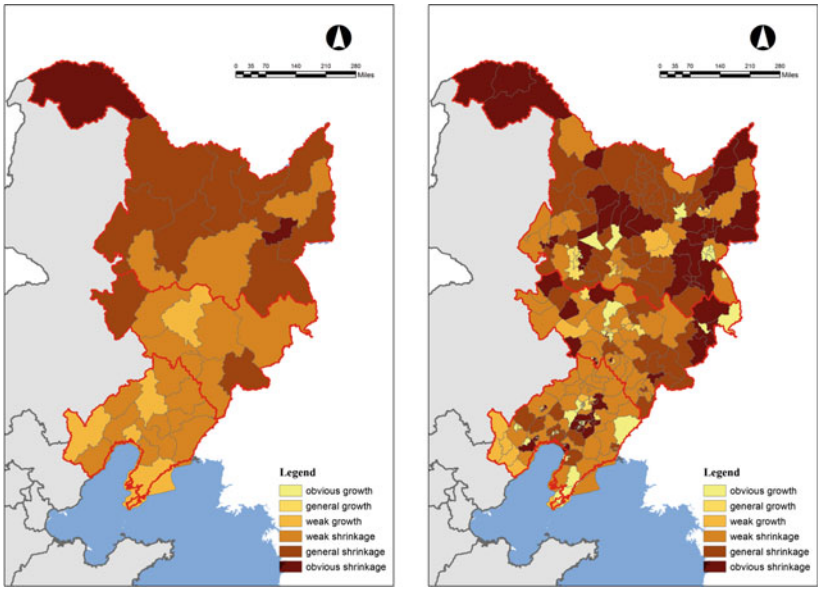

Fig. 5.5 Average annual growth rate of the household registration population in prefecture-level units (left) and district–county units (right) in Northeast China during 2008–2016. *Source* Drawn by the author

5.3.2 Space Distribution of Urban Shrinkage in Northeast China During 2008–2016

According to the statistical data from the 2008 and 2016 yearbooks, this paper analyzed the change in the household registration population in Northeast China from 2008 to 2016. The analysis made it evident that the number and scope of shrinking cities in Northeast China increased and expanded during this period, and the urban shrinkage phenomenon became more pronounced. Among the 36 prefecture-level units, 31 units experienced shrinkage at different levels, and only the population of Changchun City, Shenyang City, Chaoyang City, Panjin City, and Dalian City increased slightly. Of the 295 district–county units, 211 experienced urban shrinkage, accounting for 71.5% of the total. In terms of the spatial distribution, all cities in Heilongjiang Province experienced population shrinkage, and most of them experienced general shrinkage. Moreover, the prefecture-level units that experienced noticeable shrinkage were all located in Heilongjiang Province. Regarding the distribution of district–county units, the shrinkage phenomenon was more noticeable. Daxinganling, Yichun-Heihe, Jiamusi, and Jixi-Qitaihe-Mudanjiang-Yanbian were major gathering areas. As a whole, the shrinkage areas were continuous in space, and the shrinkage phenomenon in Heilongjiang Province was the most obvious (Fig. 5.5).

In summary, from 2008 to 2016, the urban shrinkage phenomenon was more serious than during 2000–2010, covering almost all regions in Northeast China. Therefore, the phenomenon of urban shrinkage in Northeast China tends to be more noticeable, making it necessary to explore the influencing factors and mechanisms of urban shrinkage in Northeast China.

5.4 Factors Attribution of Urban Shrinkage in Northeast China

5.4.1 Factors Identifying Urban Shrinkage in Northeast China

There are many influencing factors related to urban shrinkage. According to the summation of relevant scholars, the influencing factors of urban shrinkage may be placed into five categories, such as population changes, environmental changes, economic changes, political changes, and spatial changes, and there were several motivations and action modes in each category (Zhou and Qian 2015). The specific mechanisms were more complex, some were linear, and others were nonlinear and cyclical (Hoekveld 2012). However, an in-depth analysis showed that some factors are indeed the cause of urban shrinkage, but others are derived or strengthened from urban shrinkage and cannot be generalized. Combining related research and the actual situation in Northeast China, this paper identified the influencing factors of urban shrinkage in Northeast China from five aspects, including regional economic differences, urbanization processes, industrial structure changes, population structure changes, and adjustments in administrative divisions. This paper also conducted a Pearson correlation analysis between the socioeconomic data of the 295 district–county units and the average annual change rate of the permanent residents in Northeast China during 2000–2010. In addition, this paper took the average annual change rate of the permanent residents as the dependent variable and the socioeconomic data as the independent variable in this regression analysis. The result is as follows.

According to the Pearson correlation analysis (Table 5.1), changes in urbanization rate, changes in the proportion of secondary and tertiary industries, and changes in the proportion of over 60 are significantly correlated with the average annual change rate of permanent residents R, and the changes in the proportion of secondary and tertiary industries has the strongest correlation with R. From the results of the regression analysis (Table 5.2), only changes in the proportion of secondary and tertiary industries and changes in the proportion of over 60 are significantly related to R. Among them, the changes in the proportion of secondary industry are extremely significant with R.

Table 5.1 Pearson coefficient between average annual change rate of permanent residents R and related factors

		R	R > 0 (growth)	R < 0 (shrinkage)
Regional economic differences	Initial GDP per capita	0.087	0.188*	−0.195*
	Economic development speed	0.270**	0.304**	0.052
Urbanization process	Initial urbanization level	0.194**	0.318**	−0.255**
	Changes in urbanization rate	0.076	−0.094	0.332**
Industrial structure changes	Changes in proportion of mining industry	0.164**	0.093	0.112
	Changes in proportion of secondary industry	0.486**	0.486**	0.486**
	Changes in proportion of tertiary industry	0.605**	0.531**	0.504**
Population structure changes	Changes in birth rate	−0.045	−0.081	−0.093
	Changes in natural growth rate	0.001	−0.099	−0.032
	Changes in the proportion of 0–19	0.104	0.255**	−0.089
	Changes in the proportion of 20–34	0.276**	0.269**	−0.147
	Changes in the proportion of 35–60	−0.297**	−0.310**	0.093
	Change in the proportion of over 60	−0.253**	−0.344**	0.309**

Note ** indicates a significant correlation at the 0.01 level (bilateral); * indicates a significant correlation at the 0.05 level (bilateral)

Table 5.2 Regression analysis between average annual change rate of permanent residents R and related factors

		R			R > 0 (growth)			R < 0 (shrinkage)		
		Beta	T	Sig	Beta	T	Sig	Beta	T	Sig
Regional economic differences	Initial GDP per capita	0.081	1.465	0.144	0.177	2.004	0.048	−0.125	−1.352	0.179
	Economic development speed	−0.235	−3.437	0.001	−0.244	−2.245	0.027	0.071	0.680	0.498
Urbanization process	Initial urbanization level	0.332	4.760	0.000	0.339	2.946	0.004	0.088	0.711	0.478
	Changes in urbanization rate	0.025	0.460	0.646	−0.012	−0.143	0.887	−0.064	−0.677	0.500
Industrial structure changes	Changes in proportion of mining industry	−0.019	−0.362	0.718	−0.045	−0.581	0.563	−0.057	−0.595	0.553
	Changes in proportion of secondary industry	0.358	5.470	0.000	0.314	3.218	0.002	0.415	3.302	0.001
	Changes in proportion of tertiary industry	0.344	4.619	0.000	0.284	2.535	0.013	0.239	2.415	0.018
Population structure changes	Changes in birth rate	−0.061	−0.809	0.419	0.154	1.246	0.215	−0.231	−1.884	0.062
	Changes in natural growth rate	−0.039	−0.477	0.634	−0.276	−2.144	0.034	0.181	1.357	0.178
	Changes in proportion of 0-19	−0.027	−0.349	0.728	0.061	0.687	0.493	−0.005	−0.044	0.965
	Changes in proportion of 20–34	−0.122	−0.918	0.360	Exclude			−0.231	−1.620	0.108
	Changes in proportion of 35–60	−0.075	−0.614	0.540	0.059	0.559	0.577	0.095	0.654	0.515
	Change in proportion of over 60	−0.362	−4.682	0.000	−0.363	−3.742	0.000	−0.256	−2.304	0.023

Note Regarding the Sig value, $P > 0.05$ indicates that the difference is not significant; $0.01 < P < 0.05$ indicates that the difference is significant; $P < 0.01$ indicates that the difference is very significant

5.4.2 Regional Economic Differences and Urban Shrinkage

Regional economic differences are one of the main causes of local shrinkage by triggering China's interregional and intraregional population movements (Gao and Long 2017). How does it affect the shrinking cities in Northeast China? This paper used initial GDP per capita in 2000 and GDP growth in 2000–2010 to conduct the correlation analysis using the average annual change rate of permanent residents R during 2000–2010.

Overall, both the correlation analysis and the regression analysis showed a significant correlation between GDP growth rate and R. Further differentiating the growing and the shrinking areas, the growing areas with $R > 0$ showed a more significant positive correlation between the GDP growth rate and R. However, for shrinking areas with $R < 0$, the correlation was not significant, indicating that the relationship between urban shrinkage and the economic growth rate was not obvious during a certain period.

There was a significant correlation between the initial GDP per capita and R in both the growing and shrinking areas. For the growing areas, the initial GDP per capita showed a significant positive correlation with R, indicating that a higher initial GDP per capita resulted in an increasing average annual change rate R. However, for the shrinking areas, there was a negative correlation between the two factors, indicating that a higher initial GDP per capita resulted in a decreasing average annual change rate R.

5.4.3 Urbanization Process and Urban Shrinkage

Urbanization has a close relationship with the growth and shrinkage of cities. The population agglomeration of urbanization promotes urban growth. When urbanization reaches a certain high level, problems such as traffic congestion and environmental deterioration in the urban center prompt the development of the urban edge and shrinkage of the center. Therefore, this paper selected the urbanization rate in 2000 that reflected the initial urbanization level and the urbanization rate changes in 2000–2010 as the identification factors.

There was a clear correlation between the initial urbanization level and R in both growing and shrinking areas. For the growing areas with $R > 0$, there was a significant positive correlation between the initial urbanization level and R. However, for the shrinking areas with $R < 0$, the correlation was negative. The situation differed from the perspective of changes in the urbanization rate. On the whole, the average annual population change rate R had no obvious correlation with changes in the urbanization rate, and the same was true for growing areas with $R > 0$. However, for shrinking areas with $R < 0$, there was a significant positive correlation between changes in the urbanization rate and R. By focusing on the results of the regression analysis, it could be concluded that either the initial urbanization level or the changes in the

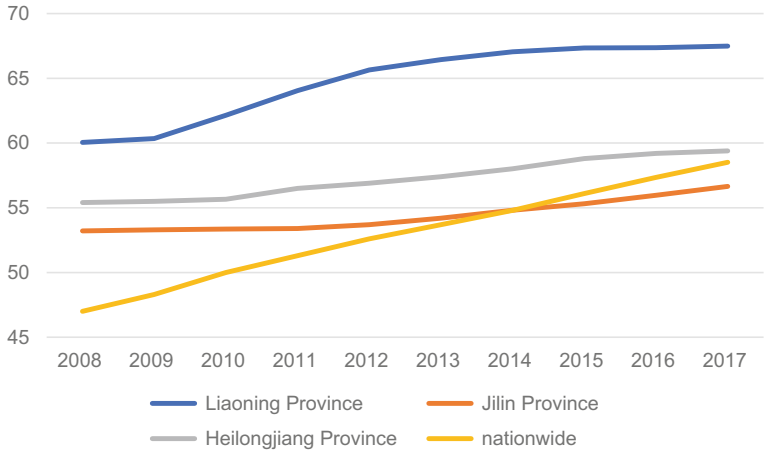

Fig. 5.6 Urbanization rate of three provinces in Northeast China from 2008 to 2017. *Sources* Statistical bulletin of three provinces during 2008–2017

urbanization rate had no significant correlation with the average annual change rate of permanent residents R.

Northeast China has always had a relatively high rate of urbanization. Throughout history, the abundant population resources brought by "braving the journey to the Northeast," which was a significant migration of the population in Chinese history, held the region as the most developed in China at that time. In 1942, the urbanization level of Northeast China reached 23.8%, whereas the nation's urbanization level reached 23.7% in 1986. Before 2015, the urbanization rate of Northeast China was far higher than the nationwide rate, but the growth rate of urbanization has slowed in recent years. In 2015, the urbanization rate in Jilin Province was lower than the nationwide rate, and the urbanization rate in Heilongjiang Province was very close to the nationwide rate. Northeast China had a high urbanization rate base, making it inevitable that the population would decrease after peaking. The results of the regression analysis prove that, although the initial urbanization rate and changes in the urbanization rate were relatively highly correlated with population changes, both were reinforced by urban shrinkage and were not the factors that affected urban shrinkage (Fig. 5.6).

5.4.4 Industrial Structure Changes and Urban Shrinkage

Related studies abroad showed that the shrinkage of many cities was related to deindustrialization and adjustments in the global economic structure (Wu et al. 2015). Northeast China has significant resource advantages, and many resource-based cities face the challenge of resource depletion and transition. At the same time, Northeast

China is in an important period for the rejuvenation of old industrial bases, and the industrial structure is being adjusted. Therefore, this paper selected changes in the number of employees in the secondary industry, the tertiary industry, and the mining industry to analyze the relationship between industrial structure changes and urban shrinkage.

There was no obvious correlation between changes in the mining industry and R for both growing and shrinking cities. It could be inferred that the transformation of resource-based cities in Northeast China was not the main factor that caused urban shrinkage. Moreover, both the correlation analysis and the regression analysis showed that there was a significant positive correlation between the structural changes in the secondary and tertiary industries and R. That is, the higher the proportion of secondary and tertiary industries, the more the city tended to grow rather than shrink. Additionally, the regression analysis showed that the Sig value of the changes in the proportion of the secondary industry in the shrinking areas was less than 0.01, indicating that the changes in the proportion of the secondary industry had an extremely significant correlation with R.

Judging from the changes in the proportion of the secondary industry during 2000–2010 (Fig. 5.7), only 9 of 34 prefecture-level units experienced a decline in the proportion of the secondary industry, and the proportions of the secondary industry in other cities were still increasing, some substantially. This finding also reflected the fact that the deindustrialization in Northeast China was still not obvious during 2000–2010, the old industrial base was solid, and the increase in the proportion of the secondary industry was still an important factor in promoting urban growth. However, the proportion of the tertiary industry in the units of Northeast China varied significantly. There were 14 units in which the proportions of the tertiary industry increased and the proportions in other units declined. Also found was that, in addition to Fushun and Yichun, the proportion of the tertiary industry in other units decreased or remained basically unchanged. Combined with the increase in the proportion of the secondary industry in most units, it could be judged that the main factor affecting urban shrinkage in the change in the industrial structure in Northeast China was not the decline in the proportion of the secondary industry caused by deindustrialization, but the shrinkage of the tertiary industry. However, given the industrial transformation of old industrial bases, the structure of the secondary and tertiary industries would inevitably be gradually adjusted, and the phenomenon of urban shrinkage would change.

Then, the paper analyzed changes in the proportion of secondary and tertiary industries during 2008–2016 and found that the situation was different. The proportions of the secondary industry in most prefecture-level units were declining, and the proportions of the tertiary industry were increasing, indicating that “deindustrialization” was obvious. The changes in the secondary and tertiary industries had a very significant positive correlation with R; that is, when the proportions of the secondary and tertiary industries increased, the city tended to grow. When the proportions of the secondary and tertiary industries declined, the city tended to shrink. Judging comprehensively, during 2008–2016, the impact of the changes in the industrial structure of Northeast China on urban shrinkage was mainly due to the decline in the proportion

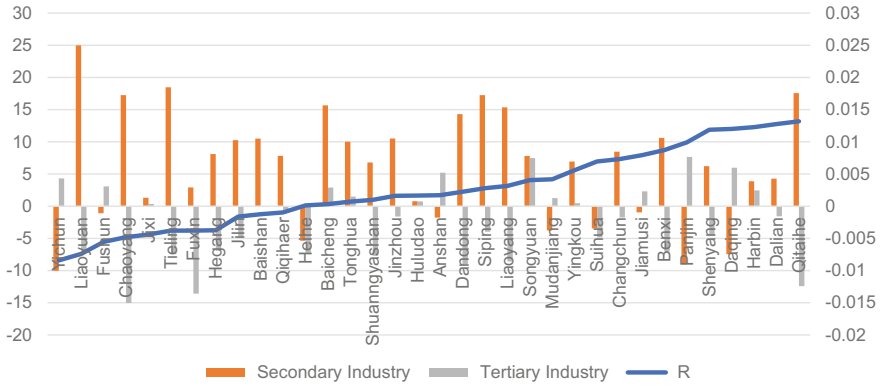

Fig. 5.7 Changes in the proportion of the secondary and tertiary industries in 34 prefecture-level units (excluding Yanbian Korean Autonomous Prefecture and Daxinganling Region) from 2000 to 2010. *Source* China Urban Statistical Yearbook 2001, 2011

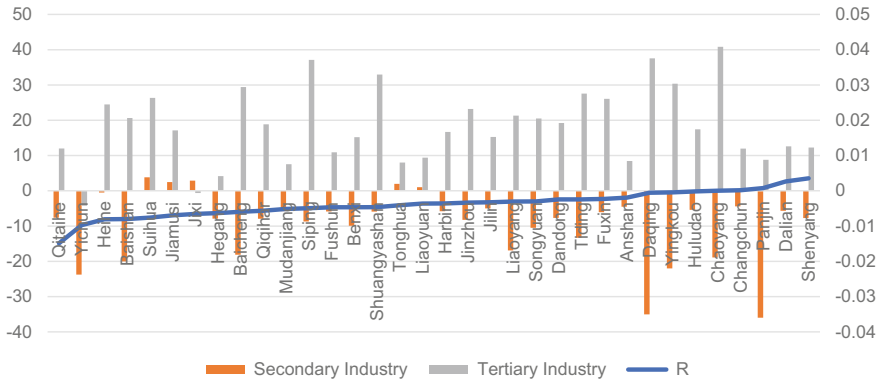

Fig. 5.8 Changes in the proportion of the secondary and tertiary industries in 34 prefecture-level units (excluding Yanbian Korean Autonomous Prefecture and Daxinganling Region) from 2008 to 2016. *Source* China Urban Statistical Yearbook 2009, 2017

of the secondary industry brought by "deindustrialization." Because of the high educational costs and barriers to entry into the high-end service industry, employment for the population that was displaced from the industry is limited and is mainly concentrated in the relatively low-end service industry. Moreover, unemployment occurs frequently, which is also an important cause of the population outflow (Fig. 5.8).

Table 5.3 Change in population in different age groups in Northeast China

	Heilongjiang Province		Jilin Province		Liaoning Province	
Year	2008	2017	2011	2017	2012	2017
0–14 (%)	12.60	10.70	12.95	12.31	10.80	10.35
15–64 (%)	78.20	77.20	78.32	75.31	78.90	75.30
Over 65 (%)	9.20	12.00	8.73	12.38	10.30	14.35

Source Statistical Yearbook of the three provinces

5.4.5 Population Structure Changes and Urban Shrinkage

In terms of population structure, Northeast China has always had a low fertility rate and the population outflow—particularly the outflow of the young and middle-aged population—is currently serious. Therefore, this paper selected factors such as changes in the birth rate, changes in the natural growth rate, and changes in the proportion of the various age groups when considering the impact of the changes in the population structure on urban shrinkage. The results indicated that there was no significant correlation between changes in the birth rate and changes in the natural growth rate and R.

The changes in the proportions in the 20–34, 35–59, and over 60 groups had significant correlations with R. The change in the proportion of 20–34 was positively correlated with R, and for growing areas with $R > 0$, but there was no significant relationship with shrinking areas. The changes in the proportion in the 35–60 and over 60 groups were negatively correlated with R; that is, the larger the proportion of the population aged 35–60 and over 60, the more the city shrank. There was also a negative correlation with growing areas. However, for shrinking areas, only the change in the proportion over 60 had a strong correlation with R, and the result was the same using the regression analysis. The higher the proportion of people over 60, the more the city tended to shrink.

It should be noted that, although the change in the structure of the population was significantly correlated with the average annual rate of change in permanent residents, it was not the factor that affected urban shrinkage but, rather, was a consequence and a characteristic of urban shrinkage. From the perspective of changes in the population structure of the three provinces in recent years (Table 5.3), the proportion of the population in the 0–14 and 15–64 groups apparently declined, and the proportion of the population over 65 increased substantially. It can be judged that the basic characteristic of urban shrinkage in Northeast China was the outflow of the young and middle-aged population. Moreover, the proportion of the elderly population has rapidly increased, resulting in a significant aging trend.

5.4.6 *Adjustment in Administrative Divisions and Urban Shrinkage*

The adjustment in administrative divisions affected a portion of the urban population because it changed the scope of the administrative units. Since 2000, zoning adjustments have been carried out in many prefecture-level and district–county units in Northeast China (as shown in Table 5.4), which led to a significant increase or decrease in the urban population. For example, in 2006, Harbin City canceled the Power District in Xiangfang District and set up a new Xiangfang District. After adjusting the administrative divisions in 2000 according to the administrative divisions in 2010, the population of Xiangfang District increased substantially, from 367,382 to 778,224, causing population shrinkage in the statistical data for Xiangfang District.

5.5 Conclusion

This paper conducted an exploratory study of urban shrinkage at the prefecture and district–county levels in Northeast China during 2000–2010 and 2008–2016, defined the spatial and temporal distribution of urban shrinkage, identified the influencing factors of urban shrinkage in Northeast China, and briefly analyzed the mechanism. The results were as follows.

From time to time, urban shrinkage during 2008–2016 in Northeast China was more significant than that during 2000–2010. During 2000–2010, nearly 1/3 of the prefecture-level units and 1/2 of the district–county level units experienced urban shrinkage. During 2008–2016, the data increased to nearly 8/9 and 3/4. Several significant agglomeration areas formed in Daxinganling, Yichun-Heihe, Jiamusi, and Jixi-Qitaihe-Mudanjiang-Yanbian. Overall, the shrinking areas were expanding. In Heilongjiang Province, in particular, the situation was serious.

The changes in the secondary and tertiary industrial structures and the adjustments in the administrative division had the strongest relevance to urban shrinkage in Northeast China, and the urban shrinkage was mainly influenced by the second industry atrophy caused by the "deindustrialization" during this time. At the same time, the adjustment in the regional division in Northeast China objectively led to a significant change in the population statistics, which caused shrinkage in some areas. Factors such as regional economic differences and declines in resource-based cities affected population changes but were not the main reasons for the urban shrinkage in Northeast China. The urbanization rate of the region had a relatively high mathematical correlation with population changes but was not an influencing factor of urban shrinkage. Northeast China had a high urbanization rate base. Additionally, it was inevitable that the population declined after reaching a peak. Changes in the population structure were a consequence and characteristic of urban shrinkage. The basic characteristic of urban shrinkage in Northeast China was a significant outflow of young people, and the proportion of the elderly population has risen rapidly.

Table 5.4 Adjustment of administrative divisions in Northeast China from 2000

Before	After	Time	Contents
Taiping District	Daowai District	2004	Taiping District of Harbin was revoked and its administrative area was placed into the jurisdiction of Daowai District
	Songbei District	2004	Songbei District was established in 2004. It administers Songbei town, Songpu town, Wanbao town, Sun Island street, and Sandian street, which previously belonged to Daowai District, as well as Leye town and Duiqingshan town, which previously belonged to Hulan County
Hulan County	Hulan District	2004	Hulan County was abolished and Hulan District was established. The administrative region of the former Hulan County (excluding Leye town and Duiqingshan town) was the administrative region of Hulan District
Power District	Xiangfang District	2006	The old Power District and Xiangfang District were canceled and a new Xiangfang District was formed
Acheng City	Acheng District	2006	Acheng City was canceled and Acheng District was established. Yongyuan Town and Juyuan Town of Acheng City were placed under the jurisdiction of Daowai District
Wensheng District	Wensheng District	2011	Wusheng, Wensheng, Fuping, Nanmen, Dongxing (excluding Hedong Entrepreneurship) were placed in Baita District; Luodatai Town of Dengta City, Dongjinglin Town of Taizihe District, and Xiaotun Town of Liaoyang County (excluding 6 administrative villages such as Yanjiatun) were placed in Wensheng District

Objectively, urban shrinkage is an urban development process and an unavoidable and diachronic issue in many cities. Therefore, it is of great significance to study the characteristics and mechanisms of these cities. However, the mechanism of urban shrinkage in Northeast China is very complicated, such as population changes and economic vitality being mutual causes and effects in particular. Therefore, the topic requires more in-depth research.

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