

Understanding Growth and Shrinkage Phenomena of Industrial and Trade Cities in Southeastern China: Case Study of Yiwu

Kang Wu, Ph.D.¹; and Xiaonan Wang²

Abstract: With the advancement of globalization and urbanization, the coexistence of growth and shrinkage in urban areas has become increasingly prominent and has implications for urban transformation. This research provided a comprehensive case study of Yiwu and used multisource spatial data to identify and analyze urban growth and shrinkage according to an analytical framework based on multidimensional changes in the population, economy, and landscape from 2012 to 2018. Township-level resident population data and the records of investment data among business enterprises are referred to as macroscopic indicators, and monthly nighttime light image data are employed to evaluate microscale environmental changes of Yiwu. The results showed a rapidly urbanizing process along with some local shrinkage areas in Yiwu. The growth areas were mainly in central Yiwu, while shrinkage occurred in the northern and southern areas. Based on the theoretical framework following the interaction between globalization and localization, both the quantitative analysis and the qualitative analysis indicated that the changes in the international trade environment and domestic environment; the advancement of *machine replacement*; the development of e-commerce economy; the renovation and improvement of the environment, which was predominantly carried out by the government of Zhejiang province, and the reform of the household registration system are all contributing to Yiwu's growth and shrinkage.

DOI: 10.1061/(ASCE)UP.1943-5444.0000628. © 2020 American Society of Civil Engineers.

Author keywords: Urban growth; Urban shrinkage; Multisource spatial data; Yiwu city.

Introduction

In the recent decades, the phenomenon of urban shrinkage has been the subject of growing interest for planning researchers, policy makers, and even the media (Martinez-Fernandez et al. 2012a, 2016). Urban shrinkage is a development path that is spreading widely across the world (Turok and Mykhnenko 2007; Kabisch et al. 2010). This phenomenon started in the old industrial regions in West Europe and expanded to postsocialist countries in East Europe, the *rust belt* regions in North America, and even recently occurred in South African and East Asian cities (Großmann et al. 2008; Kabisch 2007; Beauregard 2009; Blanco et al. 2009). According to Oswalt and Rieniets (2006), more than a quarter of the world's metropolises shrank in the 1990s, and this number would continue to increase with the continuous trend toward urbanization. Although this phenomenon is considered fairly global, its manifestations and determinants are multidimensional and complex and do not follow universal patterns (Haase et al. 2014; Martinez-Fernandez et al.

2016; Hartt 2018). Researchers have explored various explanations, including natural disasters (Vale and Campanella 2005), deindustrialization caused by sector shift and relocation (McDonald 2008), suburbanization/urban sprawl and the decline of city cores (Lang and LeFurgy 2007), the effects of postsocialist transformations (Martinez-Fernandez et al. 2012b), an aging or low-fertility rate and social transformation (Wiechmann and Pallagst 2012), and globalization and polarization of economic activities in a global context (Sassen 2001; Großmann et al. 2013).

In the more recent debate, the key theoretical literature has focused on urban dynamics under capitalism and argues that the growth and shrinkage of cities are driven by the accumulation of capital and its spatial-temporal circulation (Harvey 2006). Furthermore, scholars currently emphasize the key role of globalization in the process of population change in cities nowadays, while globalization and global production networks accelerate the scope and speed of capital circulation and foreign investment, which has resulted in the reconstruction of the global industry system and urban regional competition landscape. Therefore, globalization has continuously concentrated resources, key infrastructure, and intellectual assets in *global cities* (Sassen 2001); in light of the global value chain of transnational corporations toward a new global economic order, those cities have become the core of global economics and world city networks (Audirac 2005; Castells 2000; Harvey 2000; Dicken 2003; Swyngedouw 2004; Gereffi 2005). Unfortunately, other cities/towns and even entire regions with the development that was based on a single industry or sector particularly affected by these globalization processes have been experiencing the outflow of capital and human resources (Bontje 2004; Martinez-Fernandez et al. 2012b), and some cities were losing out and beginning to shrink (Cunningham-Sabot and Fol 2007).

To date, however, most of the case studies and assumptions in terms of urban shrinkage have been based on Western contexts, despite growing signs of urban shrinkage in newly industrialized

¹Associate Professor, Beijing Key Laboratory of Megaregions Sustainable Development Modelling and School of Urban Economics and Public Administration, Capital Univ. of Economics and Business, Beijing 100070, China (corresponding author). ORCID: <https://orcid.org/0000-0003-3251-6231>. Email: wukang@cueb.edu.cn

²Ph.D. Student and Research Associate, Beijing Key Laboratory of Megaregions Sustainable Development Modelling, Capital Univ. of Economics and Business, Beijing 100070, China; Dept. of Infrastructure Engineering, Univ. of Melbourne, Parkville, VIC 3010, Australia. ORCID: <https://orcid.org/0000-0002-8045-3055>. Email: xiaonanw5@student.unimelb.edu.au

Note. This manuscript was submitted on December 31, 2019; approved on July 8, 2020; published online on September 28, 2020. Discussion period open until February 28, 2021; separate discussions must be submitted for individual papers. This paper is part of the *Journal of Urban Planning and Development*, © ASCE, ISSN 0733-9488.

countries and developing countries, such as those in East Asia or the Asia Pacific regions (Martinez-Fernandez et al. 2016; Jeon and Kim 2020), and little is understood about the trajectories and mechanisms occurring in those shrinking cities. Considering the surprising differences with respect to the developmental stages and in the policy responses and governance models, more case studies in East Asia and the Asia Pacific should be considered.

Due to its insertion into global production networks, the establishment of a market economic system, and a *growth-oriented* governance model (e.g., *GDP-ism*; Wu 2015; Wu et al. 2015), China has witnessed a world factory and a living laboratory of urbanization in the past four decades. Scholars have often categorized Chinese urbanization into different phases based on various dynamics between state, market, and society (e.g., Gu et al. 2015; Yeh et al. 2015). In the early phases, urbanization in China was characterized by a large amount of rural-to-urban migration, as well as the rapid expansion of central cities. Although the urbanization rate rose from 17.92% in 1978 to 59.58% in 2018, Chinese cities are starting to be plagued by issues such as urban sprawl, real estate speculation, resource austerity in the megacities, and unbalanced urban and rural development that are prominent (Carolyn 2001; Li and Li 2019; Li et al. 2019; Lu et al. 2019; Wang et al. 2016). To address the issue of unbalanced urban-rural development in China, the central government called for the strategy of *revitalize the countryside* and *targeted poverty alleviation* successively (Liu and Li 2017; Liu et al. 2017). On the other hand, recent literature has highlighted the emergence of urban shrinkage in China, i.e., in cities and regions that have endured sustained population loss (Long and Wu 2016). Reflections on these issues have turned the second phase of urbanization toward a people-oriented and high-quality development mode, which is supposed to enhance urban sustainability and reduce the disparity of regional development in the long term (Bai et al. 2014).

Existing studies have reported that cities with decreasing populations are generally associated with a weak GDP or a local fiscal growth rate and can even become ghost cities in rapidly urbanizing China (Long and Gao 2019; Batty 2016). However, most of these studies have been focused on introducing the Chinese characteristics of this shrinkage phenomenon (Li and Mykhenko 2018; Yang and Dunford 2018), identifying shrinkage patterns at national or regional scales (Wu 2019; Zhang et al. 2019), or analyzing the interplay between urban growth/shrinkage and transport networks or energy emissions from an econometrics perspective (Xiao et al. 2019; Deng et al. 2019). Few studies have explored the multidimensional manifestations and complicated mechanisms combined with multisource urban data. Moreover, shrinking and growing are processes that can be observed in a parallel mode (Martinez-Fernandez et al. 2016). Besides the mining cities in Northeast China, we rarely learn about this trajectory and process in a Chinese context, especially the growth and shrinkage phenomena for medium and small industrial/trade cities in southeastern China. This paper attempts to fill these research gaps. The sections of this paper are as follows. First, the research area, analytical framework, data, and methods of this research are introduced in the following section. Then, the main results from the scope of the growth and shrinkage pattern and its mechanisms of Yiwu are presented. Finally, a brief conclusion is presented.

Methodology

Research Area

This study selected Yiwu city as the research area due to its emergence as a major national and international trade hub after

opening up in China (Li et al. 2016). Located in the eastern part of Jinhua-Quzhou basin and the central area of Zhejiang Province of China, Yiwu has an area of 1,105 km² (29°02'–29°34'N, 119°49'–120°17'E). As a county-level city, Yiwu is affiliated with the prefecture-level city of Jinhua City and is just over 100 km from Hangzhou, the provincial capital city of Zhejiang. As shown in Fig. 1, its administrative boundary consists of 14 *Jiedaos* and townships, namely, Fotang, Yiting, Jiangdong, Choujiang, Futian, Chian, Chengxi, Choucheng, Houzhai, Niansanli, Suxi, Shangxi, Beiyuan, and Dachen.

Upgraded from a county to a county-level city in 1988, Yiwu is currently a pilot city for international trade reform and the first and only county-level city to be targeted for national-level reform. According to the *Top 100 counties in 2018*, which was published by the SAIDI Institute affiliated with the Ministry of Industry and Information Technology, Yiwu was ranked ninth among the top 100 counties and county-level cities in 2018 and had a comprehensive list of strengths (Chinadaily 2018). Yiwu is famous for its role as a petty market center and has the largest small commodities wholesale framework, with a total transaction value of 452.4 billion Yuan in 2018 (Yiwu Municipal Bureau of Statistics 2019). As a minor city that has progressed from a county market to provincial, national, and finally global market in 30 years, the trajectory of Yiwu has been dubbed the *Yiwu model*, which is characterized by a local government-private entrepreneur partnership and of adaptation to new challenges as they emerged (Li et al. 2016). As a successful development model that is being replicated, it faces changes going forward, especially how to shift from low-cost, low-quality manufacturing toward higher-value manufacturing. After the financial crisis in 2008, the arrival of e-commerce and efforts to upgrade production have seen many nonlocal workers or labor forces leave Yiwu. As a small-to-medium-sized city that lacks the economies of scale in attracting high-tech industries and talent, the *Yiwu model* is entering a transition period. Therefore, exploring the urban dynamics of Yiwu is a good example of understanding urban growth and shrinkage in rapidly urbanizing Chinese contexts.

Analytical Framework

According to urban economic theory, urban development is a process in which capital and labor concentrate and circulate in different urban spaces; as a consequence, urbanization is the engine of growth in spatial dimension (Bertinelli and Black 2004). Following the theory of capitalist urbanization (Harvey 1982, 1985), which embeds the capitalism circuit in space, a *see-saw movement* of investment, disinvestment, and reinvestment makes uneven development a *normal* characteristic of capitalist urbanization. Moreover, due to the rapid devaluation of the investment process, today's investment might become a barrier to further growth in the future, resulting in urban spaces being continuously rebuilt by a new round of *spatial fixes* (Smith 1984; Harvey 2006). Therefore, accompanied by population loss and economic decline, vacancies and deteriorating space were regarded as the spatial manifestation of speculative circulation of capital in the built environment (Martinez-Fernandez et al. 2012a; Harvey 2005). In that sense, the root of urban shrinkage is the outflow of capital and human resources, which have left widespread housing vacancies, underused infrastructure, and physical decay in urban spaces (Häussermann 1996). Hence, being consistent with and extending from the existing literature (Du and Li 2017), we can understand the dynamics of growth and shrinkage from at least three dimensions: population, economy, and landscape (Fig. 2).

Economy is the main driving force of urban development, while the volume and direction of capital flows indicate the trends of

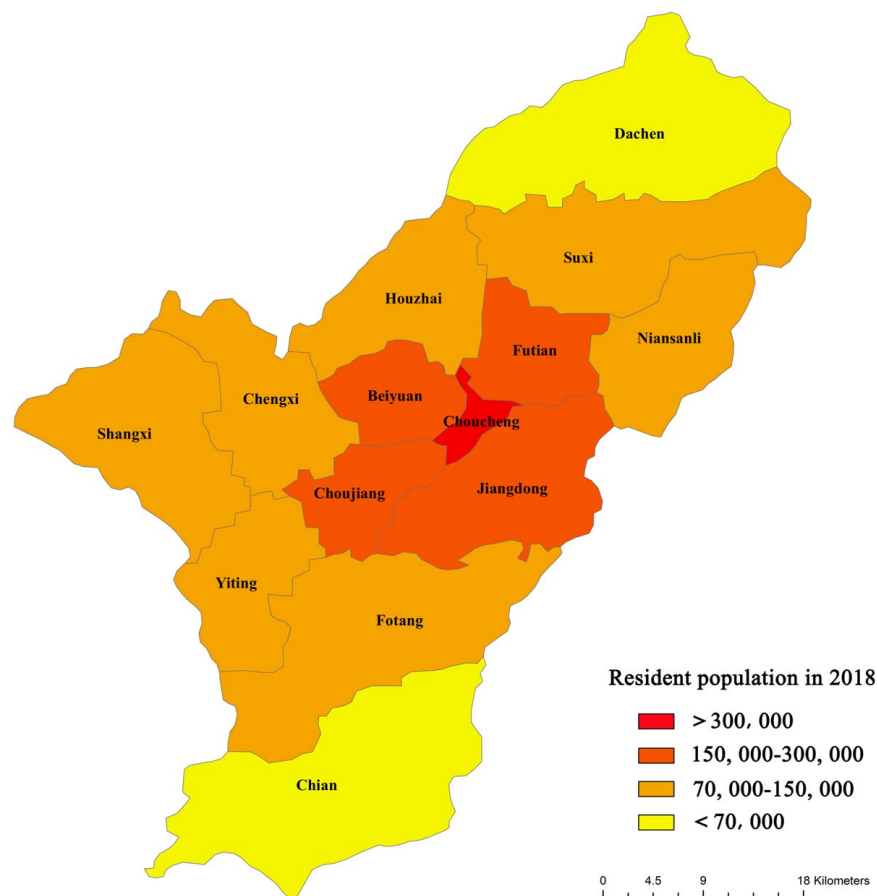


Fig. 1. Administrative division and resident population distribution of Yiwu City.

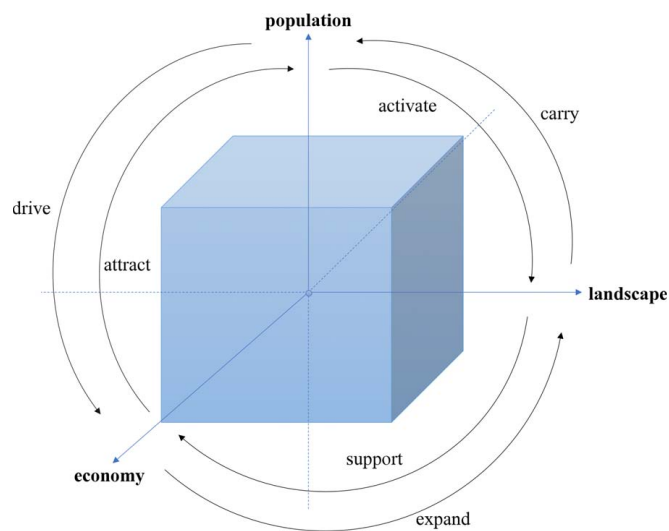


Fig. 2. Understanding the growth and shrinkage from three dimensions.

growth and decline of a city; population is the key element of urban development, and the increase and decrease in the total population reflect urban growth and shrinkage directly; the landscape represented by land use is a carrier of urban development, which supports the urban economy and population activities. The scales of urban construction land and land-use intensity are spatial manifestations of the urban economy. In this paper, we used a 3D model to build an analytical framework, and three axes were adopted to

indicate three dimensions. What needs to be emphasized is that the process of economy, population, and land use are interdependent with each other in different patterns. Fig. 2 describes the interrelationships, and according to the dynamics of growth and shrinkage between different dimensions, we classified the typologies of urban development into the following four types:

Continuous growth indicates a growth pattern in all three dimensions and shows a positive cycle within a city, generally, a city or a town which is dominated by an advanced manufacturing industry or modern service industry attracts increasing capital and labor to prompt urban expansion and improves land-use efficiency.

Transitional growth indicates growth in the economy and land use but shrinkage or stagnation in the population dimension. Some traditional manufacturing cities or towns may finally achieve their transformation and upgrade to service-dominated or new high-tech structures. However, during the transformation process, the original labor-intensive industry is replaced, and the urban economy growth stems from the rise in productivity rather than in labor input; therefore, the size of the economy and land use continues to increase.

Potential shrinkage indicates growth in population and land use while shrinkage or stagnation in the economic dimension. Although some cities and towns have better economic foundations that can help them react to the transformation, the exogenous shocks have had a great impact on economic development. The existing momentum that drives urban economic growth is weakening; nevertheless, the new sources of economic growth have not been explored, and cities are facing a risk of decline, potential population loss, and urban shrinkage.

Significant shrinkage indicates a decline in the economic dimension and a decrease in population with an expansion in urban land use. Cities or towns presenting the aforementioned characteristics are regarded as typical shrinking cities and can even become *ghost cities*.

Methodology and Data

The identification and measurement of urban growth/shrinkage is one of the debated topics in the field of shrinking cities. Although the Shrinking Cities International Research Network (SCIRN) defined the concept of shrinking cities (Wiechmann 2008; Hollander 2009), due to the high diversity of urban development in different countries, researchers could not reach a consensus on the measurement criteria for identifying a shrinking city (Wu 2019). Furthermore, Reis et al. (2016) assembled the selected metrics into three groups: landscape metrics, geospatial metrics, and spatial statistics. Overall, one of the most agreed-upon features of shrinkage was depopulation; hence, most of the existing research has operationalized population decline as the key indicator for describing urban shrinkage because it is an easily accessible and simple indicator for continuous analysis. Nevertheless, based on the manifestations of shrinking cities and their nonshrinking counterparts, we may extend the measurement or identification of urban growth and shrinkage patterns to a more comprehensive way that includes metrics of population variation, economic transformation, and land-use changes, which also follow the analytical framework (Fig. 2).

Along this line, this study draws support from multisource data. For the population dimension, we used the resident population (*Changzhu Renkou*) to reflect the population variation for each *Jiedao* or town in Yiwu city. The rate of population change (R_{pop}) was compared for the period from 2012 to 2018 according to the *Jenks natural breaks classification*. If the value of $R_{pop} > 0.02$, it indicates a growth pattern; otherwise, it indicates shrinkage or stagnation. The measurement of R_{pop} is as follows:

$$R_{pop} = \sqrt[6]{\frac{Pop_{2018}}{Pop_{2012}}} - 1 \quad (1)$$

Yiwu has made a *growth miracle* over the last three decades, so for economy dimension, the gross domestic product data cannot directly determine the economic dynamics. Therefore, considering the significance of capital flows for urban development, following the theory of capitalist urbanization (Harvey 2006), the records of investment data among business enterprises (including three types of investment: investment from enterprises, investment from executives, and investment from the legal bodies of enterprises) were adopted to reflect the dynamics of economic activities in Yiwu. Here, we aggregated both outward investments and attracted investments as the total volume of each *Jiedao* and town to measure the annual variation in capital flows (R_i) from 2012 to 2018. If $R_i > 0$, it shows a growth pattern; otherwise, it denotes shrinkage or stagnation. The measurement of R_i is as follows:

$$R_i = \sqrt[6]{\frac{Investment_{2018}}{Investment_{2012}}} - 1 \quad (2)$$

Finally, urban land-use change should be an appropriate proxy to reflect the landscape dimension. Due to the limited supply of land resources, it is difficult to reclaim natural lands after they have been built up. Similar to most cities and towns in China, Yiwu is still in the process of rapid urbanization, and construction

land continues expanding overall, which we assume has occurred in townships. In addition, we investigated the dynamics in an alternative way by using monthly nighttime light images (NTL) from the Suomi National Polar-orbiting Partnership satellite's Visible Infrared Imaging Radiometer Suite (Suomi NPP/VIIRS) day/night band to approximate the growth and shrinkage of Yiwu city by the change rate of NTL in every pixel.

All multisource data adopted in this research were obtained from the annual statistical yearbook of the Yiwu government and National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NOAA/NCEI). More specifically, the records of capital investment data were extracted from the *China industrial and commercial enterprises dataset*. This dataset covers all registered enterprises in the Bureau of Industry and Commerce in mainland China, while the resident population and gross domestic product data for 14 *Jiedaos* and townships were obtained from Yiwu statistical yearbooks, which covered 2010–2018. The variation in floating population data was obtained from the Yiwu PSB (Public Security Bureau). In addition, we also conducted a field study in Yiwu in November 2018 for a couple of days. Some interviews were conducted in the Yiwu National Tourist Commodity R&D Center and Yiwu China Commodities City Group, and leveraging those field research data and other conventional multisource data helps us to understand the mechanisms of urban changes in Yiwu more comprehensively.

NOAA provides NTL by matching pixel values and observation counts. In particular, the NTL are removed in subsequent processing if the minimum of the observation counts of pixels of the NTL is zero. As a result, 75 monthly NTL were selected to calculate the change rate of NTL. In the calculation, as shown in Fig. 3, linear regression was applied to the values of every pixel in the NTL time sequence (Wu and Wang 2019). In Python 3.6, the slope of the fitted linear equation is computed and updated into the pixel value of the resulting image. According to Li et al. (2019), pixels with slopes larger than 0.1 were identified as areas with a tendency of increasing nighttime lights, and pixels with slopes lower than -0.1 were regarded as areas with a shrinking tendency of nighttime light, while the pixels with slopes in $[-0.1, 0.1]$ were considered as areas with steady nighttime lights (Fig. 3).

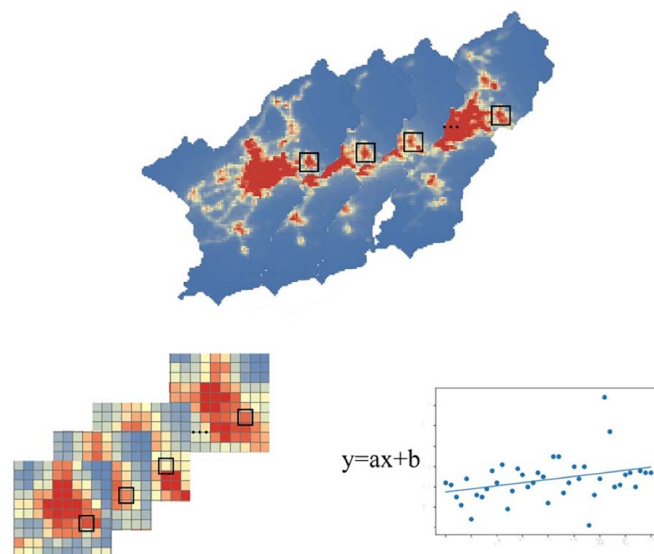


Fig. 3. Analysis of NTL.

Spatial Patterns of Growth and Shrinkage in Yiwu

Overall, the urban development of Yiwu showed a rapidly urbanization process along with some local shrinkage areas. From 2012 to 2018, more than 70% of townships (*Jiedaos* and towns) were growing (including continuous growth, transitional growth, and potential shrinkage), while four towns, accounting for nearly 30%, were still facing the situation of shrinkage (significant shrinkage). More specifically, the overall spatial pattern presented growth in the central townships and shrinkage in the northern and southern townships (Fig. 4). The towns with continuous growth included Choucheng and Jiangdong. Choucheng serves as the seat of government for Yiwu city, while Jiangdong is near the Yiwu River, with high-quality public service facilities and a superior living environment. Through the integration of traditional manufacturing and modern service, together with the promotion of the advanced manufacturing industry, net gains in people, investments, and technology are experienced in Choucheng and Jiangdong. The transitional growth towns were mainly located on the periphery of towns with continuous growth, which included Choujiang, Fotang, Yiting, and Houzhai. Impacted by the trade environment at home and abroad, changes in the population tended to result in shrinkage or stagnation for these towns. Owing to *machine replacement* and technical upgrading, labor productivity has risen, and a new Internet economy has emerged, which has incentivized the transition of labor-intensive industries and driven the resurgence in economic development. The towns with potential shrinkage were interspersed between towns with continuous growth and those with transitional growth, including Futian, Beiyuan, Chengxi, and Shangxi. The industrial system is vulnerable in towns that rely on single sectors. Although the population size seemed stable, the investments continuously fell, which indicated that they may

confront the risk of shrinkage in the near future. Finally, Chi'an, which is located in southern Yiwu, and Dachen, Suxi, and Niansanli, which are located in northern Yiwu, are the concentration areas of significant shrinkage. These towns have a weak social-economic development base and have suffered an outflow of people and investments in recent years due to the shifted trade situation and strict environmental policies.

According to the results of NPP/VIIRS source data, the changing patterns of NTL were almost the same as the distribution of growing and shrinking towns in Fig. 4. Based on the spatial resolution of 500×500 m, some transitional growth towns and towns with potential shrinkage presented patterns of *perforated shrinking* similar to that seen in Western countries (Fig. 5). We processed the NTL data separately for 2012–2015 and 2016–2018 and were able to determine the spatial-temporal differences for these two phases, which was that the former showed more pervasive shrinkage, while most of the towns resumed growth after 2015 (Fig. 6).

Compared to developed countries in the Western world, urban growth and shrinkage in fast urbanizing China tend to fluctuate more; very often, it is the external environment and the local policy guidance that triggers the disparities in urban growth and shrinkage. Overall, in typical small-to-medium-sized industrial and trade cities in southeastern China, most enterprises engage in low-cost, lower quality, and low-technology activities, while towns are dominated by the traditional manufacturing industries and even locked in the low-end of the global value chain. Most towns have difficulty upgrading to high-tech industries and modern services, especially those facing the complicated interaction of globalization and localization for the past decade.



Fig. 4. Typology of growing and shrinking townships in Yiwu from 2012 to 2018.

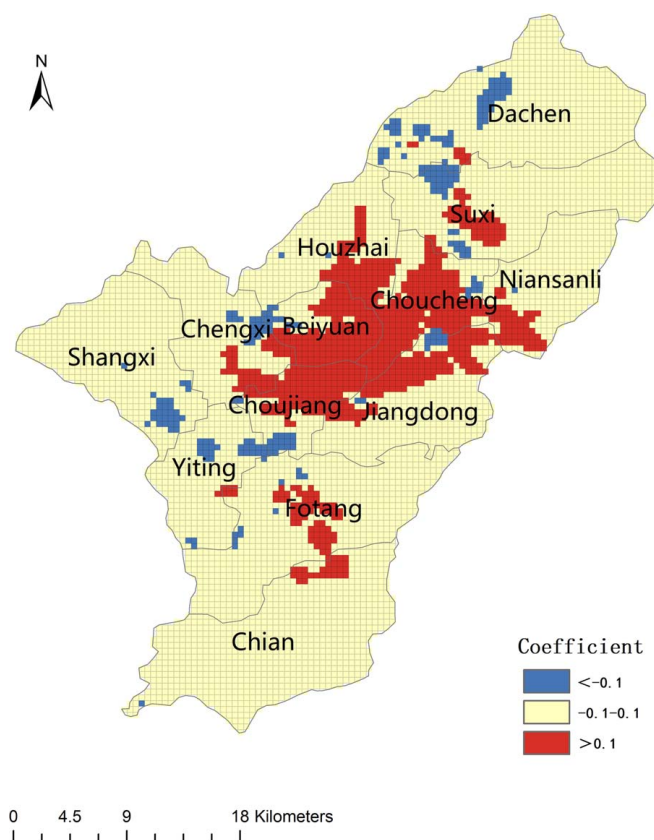


Fig. 5. Distribution of growth and shrinkage based on the resolution of 500×500 m in Yiwu from 2012 to 2018.

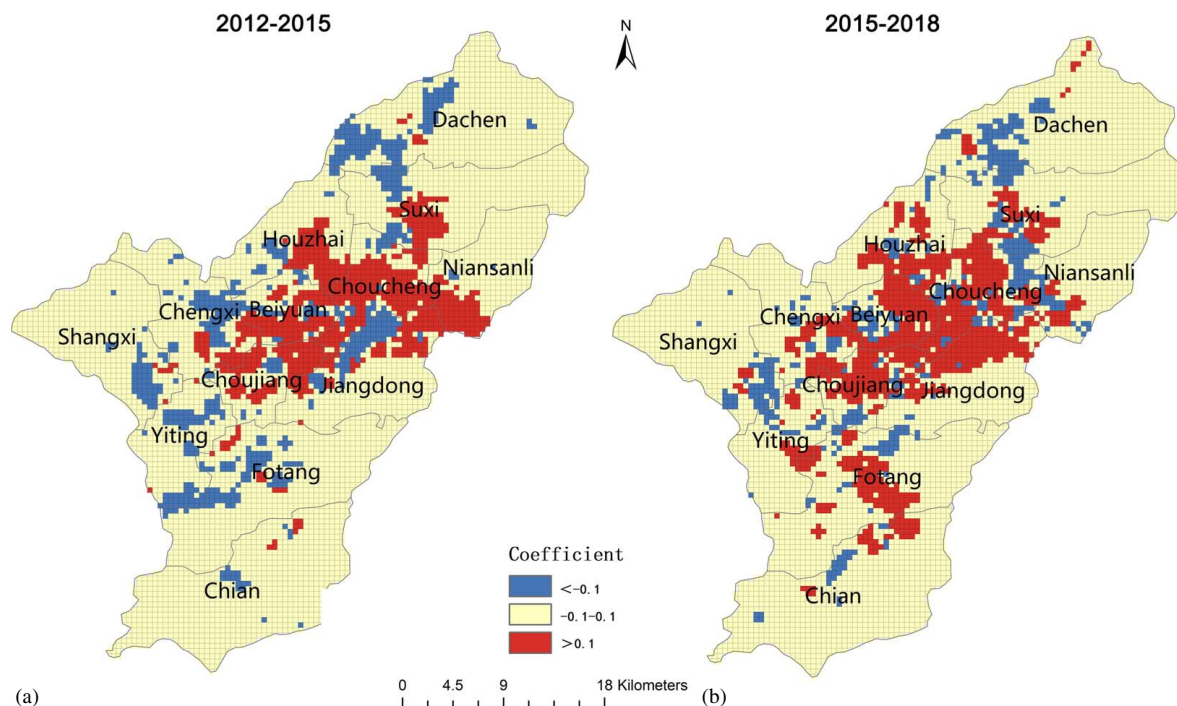


Fig. 6. Distribution of growth and shrinkage based on the resolution of 500×500 m in Yiwu from (a) 2012 to 2015 and (b) 2015 to 2018.

Mechanisms of Growth and Shrinkage in Yiwu

The development path of Yiwu city, which has been dubbed the *Yiwu model*, rested on three pillars (Li et al. 2016): the first was the early start of petty trade, termed *Jimao Huantang*; the second pillar of the model links Yiwu's markets to urban and industrial development, creating prosperity and promoting industry in the city through commerce; the last and most recent pillar was that Yiwu entered the global economy, which was implemented through attracting international conventions, cross-border e-commerce, and improving logistic system support for international trade and investment. Therefore, we may conclude that the urban development pattern of Yiwu back to the theory of agglomeration economies to grow those petty markets, globalization to embedding in global production networks, and institutional innovation characterized by a local government-private entrepreneur partnership.

In summary, there are at least four influencing factors that contribute to the growth and shrinkage phenomena, namely, changes in the domestic and foreign trade environment, a push toward industrial transformation and upgrading, comprehensive renovation of the urban environment, and reform of the household registration system. These four influencing factors are not independent but have interactions with each other (Fig. 7). Changes in the domestic and foreign trade environment have forced industrial transformation and upgrading in Yiwu and then strengthened adaptation to the domestic and foreign trade environment. On the other hand, comprehensive environmental remediation is also required to support the transformation. These factors further influence the rise and fall of enterprises and investments and the increase and decrease of labor demand through the internal branches of enterprises, and finally affecting the growth and shrinkage of the (floating) population.

Impact of the International Trade Environment

Yiwu is an open city that is highly integrated into the global value chain. Its products are exported to more than 210 countries and

regions around the world, and its dependence on foreign trade is very high. International trade is an important external driving force of urbanization and also the driving force of migration of the floating population. According to the relevant person in charge of Zhejiang China Small Commodity City Group Co., Ltd., "Yiwu has been dominated by foreign trade in recent years, with foreign trade and domestic trade accounting for 65% and 35% respectively." Therefore, the change in the international trade environment has had a profound impact on the profitability of Yiwu enterprises and then contributed to the increase and decrease in investment and population. At the same time, affected by the financial crisis in 2008, the global economic market fluctuated violently, the export growth rate of Yiwu fell sharply, and the dependence on foreign trade dropped from 33.1% to 29.3% (Fig. 8), which was thus consistent with the sharp decline in the floating population (Fig. 9). Since 2012, Yiwu's dependence on foreign countries has increased linearly, and its import and export enterprises have grown significantly, attracting a large number of floating population. In recent years, from the data perspective, Yiwu's exports have not been greatly affected. The reason is that Yiwu has a large number of export countries and a strong ability to resist risks. In recent years, Yiwu's main market has shifted from Europe and the United States to the Middle East. India, Iraq, and Iran have become the three major export countries of Yiwu. In 2018, the sanctions imposed by the United States on Iran and other countries caused severe damage to the international economic environment, and the exchange rate changes had considerable impacts on the Yiwu market. Yiwu's export market shrank on a large scale, and many enterprises closed down.

..... the whole market is closely related to the international and domestic environment. The Sino US trade war in 2018 and the economic sanctions imposed by the United States on Iran, Turkey and other countries have led to the devaluation of many countries' currencies, and the change of exchange rate has a great impact on the market. Because the currencies of these countries have to be converted into US

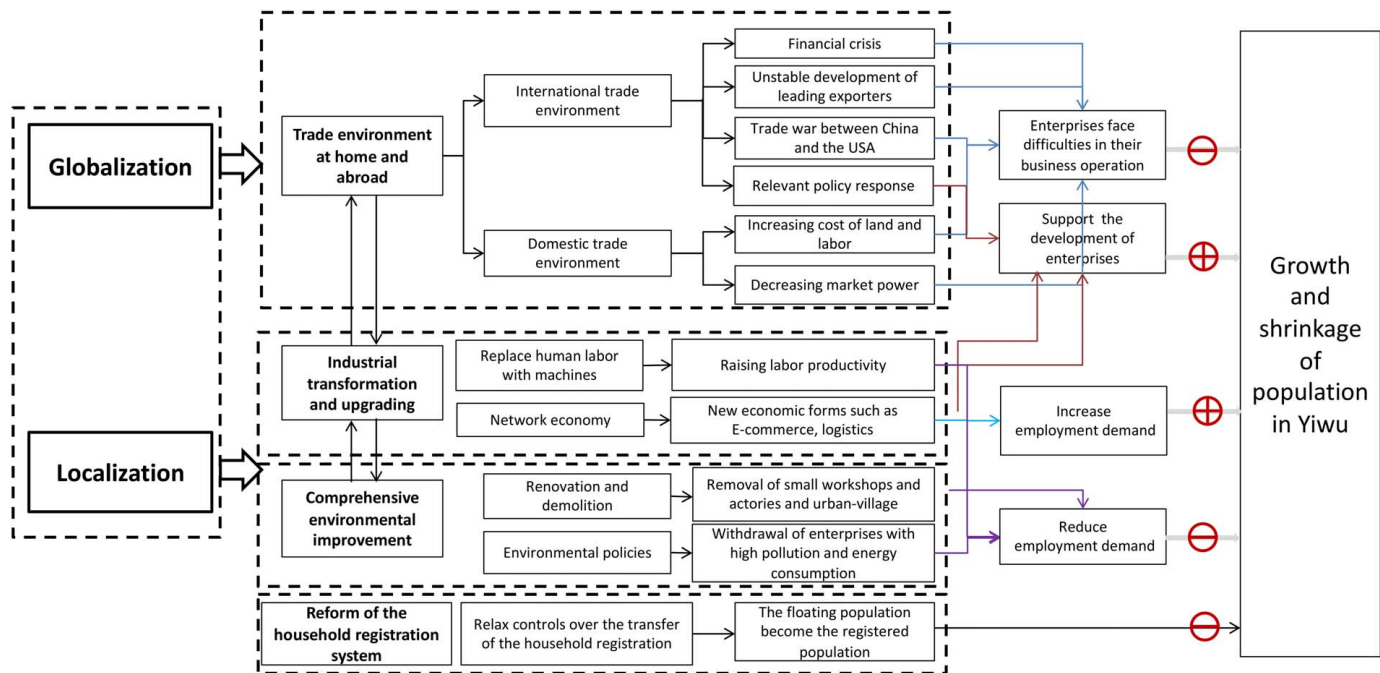


Fig. 7. Mechanisms of urban growth and shrinkage in Yiwu.

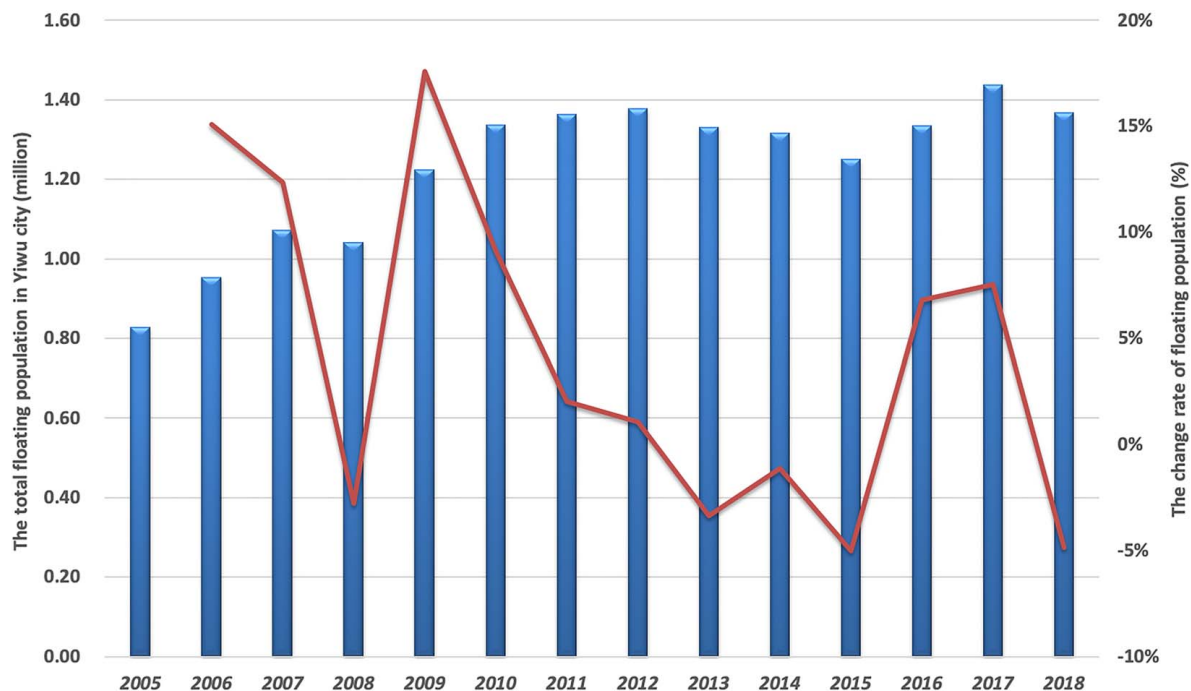


Fig. 8. Changes of floating population in Yiwu in 2005 to 2018.

dollars first, the RMB is not internationalized. For example, if the money of Turkey and Iran were to depreciate significantly, they would lose all their money even if the operators delivered to them. Iran accounts for 70% of Yiwu's foreign trade, much of which has been closed; similar impacts have occurred in Turkey.

—An interviewer of Yiwu China Commodities City Group

Additionally, in order to expand the new space of international trade in Yiwu and foster its international competitive advantage, the central government has released a number of policy dividends in

Yiwu. In 2018, eight ministries and commissions, including the National Development and Reform Commission, jointly issued "the notice on further deepening the pilot work of comprehensive reform of international trade in Yiwu, Zhejiang Province" to promote the facilitation of international trade in Yiwu. On March 12, 2018, the management committee of the Yiwu international trade comprehensive reform pilot zone was established, which means that Yiwu would explore and reform the modern trade circulation system and international trade mechanism in a wider and deeper manner. In addition, the construction of the *Yiwu wharf*, which has been called *Yiwu*

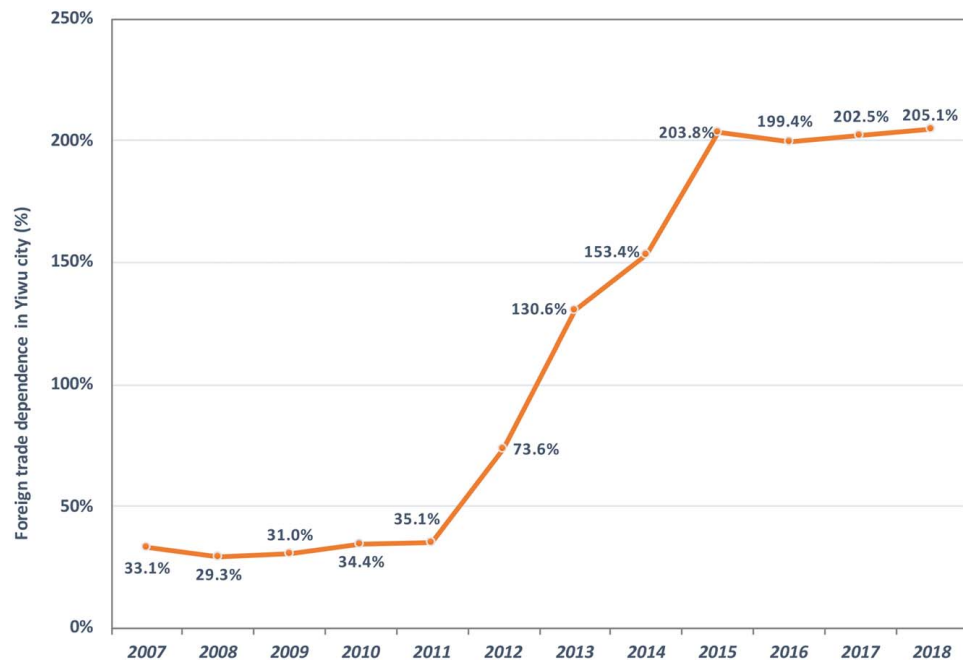


Fig. 9. Changes in foreign trade dependence of Yiwu from 2007 to 2018.

New Europe and *Yiwu-Ningbo-Zhoushan*, further enhanced Yiwu's antirisk strategy for coping with international trade instability and other aspects. The implementation of these policies and strategies has promoted the vitality and attractiveness of Yiwu city to the floating population.

Impact of Domestic Market Change

In recent years, with the rising cost of land and labor and the rising price of raw materials in Yiwu, the profit space of most labor-intensive factories has been constantly compressed, and they began to transfer to Southeast Asia and other inland areas, such as Anhui and Jiangxi. Business failure or internal migration directly affects the fate of the labor force. Most of the nonnative workers have directly returned to their hometowns for employment or started their own businesses with enterprises. In addition, many cities all over the country are trying to follow the *Yiwu model*, such as Suqian Yiwu commercial city, Lianyungang Yiwu commercial city, Xiangfan Yiwu commercial city, and Zunyi Yiwu commercial city, which are relying on the *late development advantage* to replicate the *Yiwu model* in an all-round way. The Yiwu commodity market is increasingly under the competitive pressure from other domestic markets. More importantly, with the rise in cross-border e-commerce, an increasing number of foreign-funded enterprises have direct contact with manufacturers through cross-border e-commerce platforms that bypass traditional agents. In this new mode, the competitive advantage of large-scale enterprises with integrated production and marketing is more prominent, while agents and small enterprises are facing the risk of restructuring due to the lack of commercial channels, thus reducing the attractiveness of Yiwu to the floating population.

It is uncertain whether the population in Yiwu will increase or decrease because it is not an exact research, but on the whole, it feels that there are more and more people moving out. Because the domestic market continues to radiate, Yiwu has been greatly affected. Although Yiwu has an advantage in export sales, but all talents go to large platforms. Yiwu is a small city, after all.

—An interviewer of Yiwu China Commodities City Group

Impact of “Machine Replacement”

To solve the problem of high labor costs and recruitment difficulty, at the end of 2012, the phenomenon of *machine replacement* appeared in Zhejiang's traditional manufacturing industry. Many enterprises began to introduce automation and upgrade to modern equipment. “*Machine replacement*” replaced a large number of labor-intensive manufacturing labor forces with robots, which greatly improved labor productivity and effectively reduced labor demand. From 2013 to 2017, Yiwu's *machine replacement* achieved remarkable results. The total investment in industrial technological transformation grew rapidly year by year, and its proportion in the total industrial investment is also increasing (Table 1). This situation has greatly changed the employment structure of Yiwu, eliminated low-skilled workers, and increased technical positions accordingly. However, due to the low-technology and labor-intensive industries on the whole in Yiwu, the loss of population accelerates.

Network Economy

With the advent of the Internet era, the network economy has begun to rise and become an important development mode that is complementary to the real economy. In recent years, the development of e-commerce in Yiwu has achieved remarkable results. Online trading has begun to surpass offline trading, and Yiwu's market mode has successfully changed from offline, leading to having online and offline integrated development. Specifically in recent years, in response to the call of *urban e-commerce* in Zhejiang Province, the government has issued “opinions on accelerating the development of e-commerce” and “detailed rules for the implementation of policies to promote the development of e-commerce in Yiwu” in 2015. At the same time, policies to support the development of e-commerce were successively issued, making Yiwu the center of e-commerce in China in recent years, and the volume of e-commerce transactions rose, more than quadrupling from 52.2 billion yuan in 2012 to 222 billion yuan in the present day. The development of the e-commerce economy has given rise to the growth of a large number of e-commerce service enterprises, new retail,

Table 1. Investments in industrial technological transformation and industrial investment in Yiwu from 2013 to 2017

Year	2013	2014	2015	2016	2017
Investment in industrial technological reform (100 million yuan)	60.4	71.4	89.2	92.3	123.3
Total industrial investment (100 million yuan)	108.4	123.5	125	129	167
Proportion	55.72%	57.81%	71.36%	71.55%	73.83%

Table 2. Analysis of population characteristics of Yiwu from 2006 to 2017

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Household registration population	706,684	716,285	723,889	730,183	739,838	747,392	753,314	759,902	766,604	771,570	782,220	800,013
Floating population	953,365	1,071,320	1,041,577	1,224,667	1,336,159	1,363,300	1,377,713	1,331,745	1,316,877	1,250,684	1,335,921	1,436,868
Birth population	7,037	8,174	8,220	8,101	9,955	7,701	7,937	8,739	8,829	9,162	11,296	13,693
Deaths	3,608	3,918	4,374	5,077	4,437	4,284	4,610	4,289	4,294	4,622	4,208	4,517
Natural growth	3,429	4,256	3,846	3,024	5,518	3,417	3,327	4,450	4,535	4,540	7,088	9,176
Household registration population growth	—	9,601	7,604	6,294	9,655	7,554	5,922	6,588	6,702	4,966	10,650	17,793

express logistics, e-commerce platforms, and other new formats, creating a large number of jobs, which has great attraction for the population. In addition, the ecological industrial chain of Yiwu city is centralized and perfect, with zero distance and a sufficient supply, forming a comprehensive ecological industrial chain in urban and rural areas that integrates online transactions, logistics and distribution, financial payment, and other fields. In addition, with the developed sea channels, land and air transport channels form a global and national logistics and distribution network. In addition, the unique probusiness atmosphere of Yiwu also brings many entrepreneurs to start a business in Yiwu.

Nowadays, the online and offline integration is very high in Yiwu. In 2017, the turnover of essential small malls was 126.1 billion yuan, and the turnover of e-commerce was 222 billion yuan. The degree of online and offline integration is of great significance to the Yiwu market.

—An interviewer of Yiwu China Commodities City Group

Comprehensive Environmental Improvement Policy

With the continuous promotion of China's ecological civilization strategy, enterprises with high pollution and high energy consumption that do not meet the national emission standards and local development requirements are forced to close. As a national small commodity manufacturing base, Yiwu's advantageous industries, such as clothing, socks, accessories, zippers, handicrafts, and pen making, are mostly high-pollution, high-emission, and high labor-intensity industries. Under the pressure of environmental protection policy, these small workshops and factories were first hit by the crisis. They could only adopt by closing or employing immigration strategies to reduce employment demand. This promoted the outflow of the floating population. In addition, the provincial government issued opinions on the implementation of dealing with illegal buildings in the *three changes and one demolition* (*Sangaiyichai*) action in Zhejiang Province in May 2013. It required that "through three years of efforts, the renovation of old residential areas, old factory buildings and old villages in the city will achieve the comprehensive promotion of illegal buildings demolition work and achieve results, and illegal construction activities will be fully curbed." Yiwu responded to the call actively, supplemented it with environmental remediation, and strictly inspected such behaviors as *three in one* (*Sanheyi*) unlicensed small workshops. Villages in the city and many illegal

buildings have been demolished and rebuilt, and a large number of floating populations live in uncertainty, leaving Yiwu. This is consistent with the significant decline in the floating population data from 2013 to 2015 (Fig. 7).

Reform of the Household Registration System

In recent years, the floating population has had a strong desire to settle down in Yiwu. The floating population's household registration has become a new feature of the population change in Yiwu. From 2006 to 2015, the natural population growth of Yiwu city remained at a low level. Since the promulgation of the *two child* policy in October 2015, Yiwu saw a significant increase in the number of births in 2016 and 2017. However, overall, the amount of natural growth was far lower than the average annual growth in the registered population, which showed that the growth in the registered population in Yiwu mainly came from the registered population of the floating population. An increasing floating population was willing to settle down in Yiwu city with the relaxation of the migration policy and the promotion of the equalization of public services. Particularly, in June 2016, the Yiwu municipal government and office issued a notice on distributing opinions on the reform of the Yiwu household registration system, which clearly proposed "moderately adjusting and relaxing the household registration and migration policy." In 2017, the household registration of the floating population in Yiwu city reached a new high level, with an increase of 8,617 (Table 2), which to some extent offset the proportion of the floating population in the total population, reflecting the relative loss of the floating population.

Conclusions

Yiwu created a *growth miracle* over recent decades. As a major national and international trade hub after opening up in China, it has the distinctive characteristics of creating prosperity and promoting the industry through commerce, which has attracted the focus of academics and policy makers. After 2008, the coexistence of growth and shrinkage has become increasingly prominent in Yiwu, which shows in a rapid urbanization process along with some local shrinkage areas. The overall spatial pattern had presented growth in the central areas/towns and shrinkage in the northern and southern areas/towns. Four urban types, following the typology of urban trajectories in different dimensions, were

explored: towns with continuous growth, towns with transitional growth, towns with potential shrinkage, and the towns with significant shrinkage. The influencing factors that contributed to the growth and shrinkage phenomena in Yiwu included domestic and international trade environment changes, a push toward industrial transformation and upgrading that was dominated by the government, comprehensive renovation of the urban environment, and reform of the household registration system. These factors are not independent, but rather are interrelated.

The main contribution of this research lies in three aspects. On the one hand, by building an analytical framework with three dimensions, we extended the description of urban growth and shrinkage from the existing literature, which focuses on the dimension dominated by population, to a broader and more comprehensive narrative. Based on the theoretical analysis on the interaction process of population, capital and landscape, we tried to delineate the dynamics of growth and shrinkage from three dimensions that included population variation, investment flows, and land-use change, which deepened the understanding of urban shrinkage, especially for the shrinking industrial and trade cities in rapidly urbanizing countries.

On the other hand, the study explored refreshing multisource data, especially some new emerging spatial data that have rarely been used before. Harvey proposed the theory of capitalist urbanization, which explained urban shrinkage as the result of capital movement rather than people. However, due to the data deficiency, no studies have employed empirical observations from the capital perspective. We also explored spatial-temporal analysis of growth and shrinkage at a finer-scale by using NTL data, which showed a more accurate and dynamic comparison to previous studies. In addition to the new data and quantitative measurement, we also combined surveys and interviews to conclude the potential explanations under the interaction of globalization and localization, which helped us to understand the urban change mechanisms in the context of China.

In addition, compared to the trajectories of cities in Western developed countries, our research explored the dynamics and urban growth and shrinkage with Chinese characteristics. This was reflected not only by the coexistence of expansion and shrinkage that was observed in a parallel mode in Yiwu (Long and Wu 2016) but also revealed by the spatial-temporal disparities and volatility. Because China continues to urbanize, the rapid urbanization process still plays a leading role in future urban changes, and small and medium-sized trade cities such as Yiwu are more easily affected by external impacts in the context of the complex interaction of globalization and localization. Therefore, our study adds to the knowledge of urban shrinkage and planning with evidence from a still underrepresented part of the world. For the Yiwu case, whether population shrinkage is just a temporary phenomenon or continues to spread is still an open question that needs to be explored further.

Moreover, our research provides some implications for the urban planning community in China, especially for those small-medium cities. First and foremost, the obsession with *planning for growth* should be reconsidered. In the context of the complicated process of globalization and localization, the urbanization logic is reconstructing, the development between cities and internal is becoming increasingly polarized, more and more cities in China present a coexistence pattern of growth and shrinkage, small-to-medium sized cities are more likely losing population than their counterparts. Therefore, the local government of those small-medium sized shrinking cities should adapt quickly to this new normal rather than resist, and prepare to right-sizing and even down-sizing the city to promote the urban function, and advocate the inventory planning rather than increment development. Second, the dynamics of Yiwu's case also indicate the

importance of industrial diversity to urban economic resilience (Brown and Greenbaum 2017), which could enhance risk resisting capabilities when confronting the external shocks, such as the financial crisis and the Sino US trade war.

There are still some limitations in the research thus far, especially for discussions on the mechanisms of growth and shrinkage in Yiwu. We tried to conclude the potential explanations in an academic way, but the explanations are not very in-depth. As a preliminary study, we perform further investigations in the next step. Currently, China is turning to the second round of urbanization, and the development gap among cities is emerging. Analyzing the diversity of growing and shrinking cities and linking population changes to industry upgrading, social transformation, and even urban sustainability deserves timely attention from both theoretical buildings and empirical approaches.

Data Availability Statement

Some or all data, models, or code used during the study were provided by a third party (http://www.yw.gov.cn/11330782002609848G/a/07/03_1/2019/gb/index.html; https://ngdc.noaa.gov/eog/viirs/download_dnb_composites.html). Direct request for these materials may be made to the provider as indicated in the Acknowledgments.

Acknowledgments

This research was funded by the Natural Science Foundation of China (Grant Nos. 41671161, and 71733001), the Youth Talent Support Program of Beijing Municipal Education Commission (Grant No. CIT&TCD201804097), and the Fundamental Research Funds for the Capital University of Economics and Business (Grant No. QNTD202009).

References

- Audirac, I. 2005. "Information technology and urban form: Challenges to smart growth." *Int. Reg. Sci. Rev.* 28 (2): 119–145. <https://doi.org/10.1177/0160017604273624>.
- Bai, X., P. Shi, and Y. Liu. 2014. "Realizing China's urban dream." *Nature* 509 (7499): 158–160. <https://doi.org/10.1038/509158a>.
- Batty, M. 2016. "Empty buildings, shrinking cities and ghost towns." *Environ. Plann. B: Plann. Des.* 43 (1): 3–6. <https://doi.org/10.1177/0265813515619858>.
- Beauregard, R. 2009. "Urban population loss in historical perspective: United States, 1820–2000." *Environ. Plann. A: Economy Space* 41 (3): 514–528. <https://doi.org/10.1068/a40139a>.
- Bertinelli, L., and D. Black. 2004. "Urbanization and growth." *J. Urban Econ.* 56 (1): 80–96. <https://doi.org/10.1016/j.jue.2004.03.003>.
- Blanco, H., M. Alberti, A. Forsyth, K. J. Krizek, D. A. Rodríguez, E. Talen, and C. Ellis. 2009. "Hot, congested, crowded and diverse: Emerging research agendas in planning." *Prog. Plann.* 71 (4): 153–205. <https://doi.org/10.1016/j.progress.2009.03.001>.
- Bontje, M. 2004. "Facing the challenge of shrinking cities in East Germany: The case of Leipzig." *Geojournal* 61 (1): 13–21. <https://doi.org/10.1007/s10708-005-0843-2>.
- Brown, L., and R. T. Greenbaum. 2017. "The role of industrial diversity in economic resilience: An empirical examination across 35 years." *Urban Stud.* 54 (6): 1347–1366. <https://doi.org/10.1177/0042098015624870>.
- Carolyn, C. 2001. "'Zone fever', the arable land debate, and real estate speculation: China's evolving land use regime and its geographical contradictions." *J. Contemp. China* 10 (28): 445–469. <https://doi.org/10.1080/10670560120067135>.

- Castells, M. 2000. *The rise of the network society*. Malden, MA: Blackwell Publishers.
- Chinadaily. 2018. "Top 100 counties economy with comprehensive strength list in 2018 was released, 2018." August 10, 2019.
- Cunningham-Sabot, E., and S. Fol. 2007. "Schrumpfende Städte in Westeuropa: Fallstudien aus Frankreich und Grossbritannien" [Shrinking cities in Western Europe: Case studies from France and Great Britain]. *Berl. Debatte Initial* 1: 22–35.
- Deng, T., D. Wang, Y. Yang, and H. Yang. 2019. "Shrinking cities in growing China: Did high speed rail further aggravate urban shrinkage?" *Cities* 86: 210–219. <https://doi.org/10.1016/j.cities.2018.09.017>.
- Dicken, P. 2003. *Global shift: Reshaping the global and economic map in the 21st century*. New York: Guilford Press.
- Du, Z., and X. Li. 2017. "Growth or shrinkage: New phenomena of regional development in the rapidly-urbanising Pearl River Delta." *Acta Geogr. Sin.* 72 (10): 1801–1811. <https://doi.org/10.11821/dlxb201710006>.
- Gereffi, G. 2005. "The global economy: Organization, governance, and development." In *The handbook of economic sociology*, 2nd ed., edited by N. J. Smelser and R. Swedberg, 160–182. Princeton, NJ: Princeton University Press and the Russell Sage Foundation.
- Großmann, K., M. Bontje, A. Haase, and V. Mykhnenko. 2013. "Shrinking cities: Notes for the further research agenda." *Cities* 35: 221–225. <https://doi.org/10.1016/j.cities.2013.07.007>.
- Großmann, K., A. Haase, D. Rink, and A. Steinführer. 2008. "Urban shrinkage in East central Europe? Benefits and limits of a cross-National transfer of research approaches." In *Declining cities/developing cities: Polish and German perspectives*, edited by M. Nowak and M. Nowosielski, 77–99. Poznan, Poland: Instytut Zachodni.
- Gu, C., C. Kesteloot, and I. G. Cook. 2015. "Theorising Chinese urbanisation: A multi-layered perspective." *Urban Stud.* 52 (14): 2564–2580. <https://doi.org/10.1177/0042098014550457>.
- Haase, A., D. Rink, K. Grossmann, M. Bernt, and V. Mykhnenko. 2014. "Conceptualizing urban shrinkage." *Environ. Plann. A: Economy Space* 46 (7): 1519–1534. <https://doi.org/10.1068/a46269>.
- Hartt, M. 2018. "The diversity of North American shrinking cities." *Urban Stud.* 55 (13): 2946–2959. <https://doi.org/10.1177/0042098017730013>.
- Harvey, D. 1982. *The limits to capital*. Oxford, UK: Basil Blackwell.
- Harvey, D. 1985. *The urbanization of capital: Studies in the history and theory of capitalist urbanization*. Baltimore: Johns Hopkins University Press.
- Harvey, D. 2000. *Spaces of hope*. Edinburgh, UK: Edinburgh University Press.
- Harvey, D. 2005. *A brief history of neoliberalism*. Oxford, UK: Oxford University Press.
- Harvey, D. 2006. *Space of global capitalism: Towards a theory of uneven geographical development*. London: Verso.
- Häussermann, H. 1996. "From the socialist to the capitalist city: Experiences from Germany." In *Cities after socialism. Urban and regional change and conflict in post-socialist societies*, edited by G. Andrusz, M. Harloe, and I. Szelenyi, 214–231. Oxford, UK: Blackwell.
- Hollander, J. 2009. *Polluted and dangerous: America's worst abandoned properties and what can be done about them*. Burlington, VT: University of Vermont Press.
- Jeon, Y., and S. Kim. 2020. "Housing abandonment in shrinking cities of East Asia: Case study in Incheon, South Korea." *Urban Stud.* 57 (8): 1749–1767. <https://doi.org/10.1177/0042098019852024>.
- Kabisch, N., D. Haase, and A. Haase. 2010. "Evolving reurbanisation? Spatio-temporal dynamics exemplified at the eastern German city of Leipzig." *Urban Stud.* 47 (5): 967–990. <https://doi.org/10.1177/0042098009353072>.
- Kabisch, S. 2007. "Shrinking cities in Europe reshaping living conditions in post-communist cities: Experiences from eastern Germany." In *Housing and environmental conditions in post-communist countries*, edited by B. Komar, and B. Kucharczyk-Brus, 175–192. Gliwice, Poland: Silesian University of Technology.
- Lang, R. E., and J. LeFurgy. 2007. *Boomburbs: The rise of America's accidental cities*. Washington, DC: Brookings Institution Press.
- Li, G., and F. Li. 2019. "Urban sprawl in China: Differences and socio-economic drivers." *Sci. Total Environ.* 673: 367–377. <https://doi.org/10.1016/j.scitotenv.2019.04.080>.
- Li, H., and V. Mykhnenko. 2018. "Urban shrinkage with Chinese characteristics." *Geog. J.* 184 (4): 398–412. <https://doi.org/10.1111/geogj.12266>.
- Li, R., Q. Wang, and K. C. Cheong. 2016. "From obscurity to global prominence—Yiwu's emergence as an international trade hub." *Cities* 53: 8–17. <https://doi.org/10.1016/j.cities.2015.12.009>.
- Li, X., X. Li, and J. Deng. 2019. "The growth and shrinkage of China's rapidly urbanizing areas from the perspective of property rights: A case study of Dongguan." [In Chinese.] *Trop. Geogr.* 39 (1): 1–10. <https://doi.org/10.13284/j.cnki.rddl.003104>.
- Liu, Y., and Y. Li. 2017. "Revitalize the world's countryside." *Nature* 548 (7667): 275–277. <https://doi.org/10.1038/548275a>.
- Liu, Y., J. Liu, and Y. Zhou. 2017. "Spatio-temporal patterns of rural poverty in China and targeted poverty alleviation strategies." *J. Rural Stud.* 52: 66–75. <https://doi.org/10.1016/j.jrurstud.2017.04.002>.
- Long, Y., and S. Gao, eds. 2019. *Shrinking cities in China*. Singapore: Springer.
- Long, Y., and K. Wu. 2016. "Shrinking cities in a rapidly urbanizing China." *Environ. Plann. A: Economy Space* 48 (2): 220–222. <https://doi.org/10.1177/0308518X15621631>.
- Lu, L., H. Guo, C. Corbane, and Q. Li. 2019. "Urban sprawl in provincial capital cities in China: Evidence from multi-temporal urban land products using Landsat data." *Sci. Bull.* 64 (14): 955–957. <https://doi.org/10.1016/j.scib.2019.04.036>.
- Martinez-Fernandez, C., N. Kubo, A. Noya, and T. Weyman. 2012a. *Demographic change and local development: Shrinkage, regeneration and social dynamics*. Paris: OECD.
- Martinez-Fernandez, C., T. Weyman, S. Fol, I. Audirac, E. Cunningham-Sabot, T. Wiechmann, and H. Yahagi. 2016. "Shrinking cities in Australia, Japan, Europe and the USA: From a global process to local policy responses." *Prog. Plann.* 105: 1–48. <https://doi.org/10.1016/j.progress.2014.10.001>.
- Martinez-Fernandez, C., C. T. Wu, L. K. Schatz, N. Taira, and J. G. Vargas-Hernández. 2012b. "The shrinking mining city: Urban dynamics and contested territory." *Int. J. Urban Reg. Res.* 36 (2): 245–260. <https://doi.org/10.1111/j.1468-2427.2011.01094.x>.
- McDonald, J. F. 2008. *Urban America: Growth, crisis, and rebirth*. Armonk, NY: M.E. Sharpe.
- Oswalt, P., and T. Rieniets, eds. 2006. *Atlas of shrinking cities*. Hatje: Ostfildern.
- Reis, J. P., E. A. Silva, and P. Pinho. 2016. "Spatial metrics to study urban patterns in growing and shrinking cities." *Urban Geogr.* 37 (2): 246–271. <https://doi.org/10.1080/02723638.2015.1096118>.
- Sassen, S. 2001. *The global city: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.
- Smith, N. 1984. *Uneven development: Natural, capital, and the production of space*. Oxford, UK: University of Georgia Press.
- Swyngedouw, E. 2004. "Globalisation or localisation? Networks, territories and rescaling." *Cambridge Rev. Int. Affairs* 17 (1): 25–48. <https://doi.org/10.1080/0955757042000203632>.
- Turok, I., and V. Mykhnenko. 2007. "The trajectories of European cities, 1960–2005." *Cities* 24 (2): 165–182. <https://doi.org/10.1016/j.cities.2007.01.007>.
- Vale, L. J., and T. J. Campanella, eds. 2005. *The resilient city: How modern cities recover from disaster*. Oxford, UK: Oxford University Press.
- Wang, Y., Y. Liu, Y. Li, and T. Li. 2016. "The spatio-temporal patterns of urban-rural development transformation in China since 1990." *Habitat Int.* 53: 178–187. <https://doi.org/10.1016/j.habitatint.2015.11.011>.
- Wiechmann, T. 2008. "Errors expected—aligning urban strategy with demographic uncertainty in shrinking cities." *Int. Plann. Stud.* 13 (4): 431–446. <https://doi.org/10.1080/13563470802519097>.
- Wiechmann, T., and K. M. Pallagst. 2012. "Urban shrinkage in Germany and the USA: A comparison of transformation patterns and local strategies." *Int. J. Urban Reg. Res.* 36 (2): 261–280. <https://doi.org/10.1111/j.1468-2427.2011.01095.x>.
- Wu, F. 2015. *Planning for growth: Urban and regional planning in China*. London: Routledge.
- Wu, K. 2019. "Urban shrinkage in the Beijing-Tianjin-Hebei Region and Yangtze River Delta: Pattern, trajectory and factors." In *Shrinking cities in China*, edited by Y. Long, and S. Gao, 43–61. Singapore: Springer.
- Wu, K., Y. Long, Q. Mao, and X. Liu. 2015. "Mushrooming Jiedaos, growing cities: An alternative perspective on urbanizing China."

- Environ. Plann. A: Economy Space* 47 (1): 1–2. <https://doi.org/10.1068/a140066g>.
- Wu, K., and X. Wang. 2019. “Aligning pixel values of DMSP and VIIRS nighttime light images to evaluate urban dynamics.” *Remote Sens.* 11 (12): 1463. <https://doi.org/10.3390/rs11121463>.
- Xiao, H., Z. Duan, Y. Zhou, N. Zhang, Y. Shan, X. Lin, and G. Liu. 2019. “CO₂ emission patterns in shrinking and growing cities: A case study of Northeast China and the Yangtze River Delta.” *Appl. Energy* 251: 113384. <https://doi.org/10.1016/j.apenergy.2019.113384>.
- Yang, Z., and M. Dunford. 2018. “City shrinkage in China: Scalar processes of urban and hukou population losses.” *Reg. Stud.* 52 (8): 1111–1121. <https://doi.org/10.1080/00343404.2017.1335865>.
- Yeh, A. G., F. F. Yang, and J. Wang. 2015. “Economic transition and urban transformation of China: The interplay of the state and the market.” *Urban Stud.* 52 (15): 2822–2848. <https://doi.org/10.1177/0042098015597110>.
- Yiwu Municipal Bureau of Statistics. 2019. “Summary of Yiwu socio-economic development 2018.” [In Chinese.] Accessed August 10, 2019. http://www.yw.gov.cn/art/2019/11/13/art_1229144046_1367105.html.
- Zhang, Y., Y. Fu, X. Kong, and F. Zhang. 2019. “Prefecture-level city shrinkage on the regional dimension in China: Spatiotemporal change and internal relations.” *Sustainable Cities Soc.* 47: 101490. <https://doi.org/10.1016/j.scs.2019.101490>.