Real estate supports rapid development of China's urbanization

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ABSTRACT

Urbanization is an important engine of modernization and economic growth, and appears to be an inevitable trend in human socioeconomic development around the world. However, China's unusually rapid urbanization rate has attracted increasing attention. Our research suggests that understanding the country's real estate market is the key to understanding the country's rapid urbanization. The booming real estate market represents a major source of funding for urban infrastructure construction, and has accelerated the migration of rural residents to cities. We describe how four typical Chinese cities supported urbanization by promoting the development of different aspects of a real estate market to illustrate real estate's role in Chinese urbanization, thereby providing examples and cautions for urbanization both in China and in other parts of the developing world.

1. Introduction

Urbanization has been a defining global phenomenon and a key driving force for social and economic development during the past century (Njoh, 2003; Liu et al., 2014). Urbanization is the process of transferring people and their ability to work from rural areas to urban areas, accompanied by a national transition from an economy dominated by agriculture to one dominated by secondary and tertiary industries (Deng et al., 2018). On the one hand, urbanization concentrates industries and population in and around cities, facilitating the development of economies of scale (Li, 2017). On the other hand, urbanization brings benefits such as improved employment opportunities, sanitation, income, and access to infrastructure services (Liang and Yang, 2019). Therefore, urbanization is an important engine of modernization and economic growth, and is considered to be an inevitable trend in the development of human society (Bai et al., 2014; Wei et al., 2017).

However, many problems accompany urbanization, including environmental degradation, resource scarcities, and increased crime rates (Saboor et al., 2017; Liu and Li, 2017). Without neglecting these problems, we will focus here on the benefits. Since urbanization requires a huge investment in infrastructure, such as urban roads, water, electricity, gas, communication networks, and other infrastructure, finding the necessary funds has become a major obstacle in some cases (Chen et al., 2019b). The traditional source of this funding has been long-term taxation, but the history of developed countries shows that inefficient tax and financial systems cannot meet this investment demand (Wu

et al., 2016; Cai et al., 2019). In some historical cases, and especially during colonization of developing nations by developed nations, urbanization had been paid for by the colonizer plundering the native people, leading to large-scale social unrest (Lilley, 2000). In the absence of efficient taxation and with development driven by citizens rather than colonizers, raising funds peacefully to support urban infrastructure construction has become a major challenge.

Despite China being the world's largest developing country, its urbanization has progressed at an unprecedented rate (Xiang et al., 2011). The proportion of China's population living in cities increased from 17.9 % in 1978 to 58.5 % in 2017 (NBS, 1979-2018). This influx has been the fundamental driving force for China's large-scale urban construction (Zheng et al., 2014). If the current trend continues, China's urbanization rate will reach 70 % by 2030, and more than 1 billion Chinese will live in urban areas (Wei et al., 2016). Although China's urbanization rate is still lower than that of most developed countries due to China's enormous population, the country's urbanization has attracted increasing attention around the world (Cao et al., 2014).

Although urbanization itself is easy to measure, it's not clear where the capital that sustains this process has come from. This is an important question to answer, since different sources create different constraints and different consequences. Most of the existing literature has studied the impact of land finance (i.e., using land as a source of capital for investment) on urbanization. Few studies have described the key factors that support the government's urbanization through land finance (Chen et al., 2011; Wang et al., 2018; Yang et al., 2018). In the present study, our goal was to provide insights into how China has

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raised the funds required to support its rapid urbanization. In summary, we demonstrate the novel finding that China's real estate market has provided large amounts of money to fund urban development. To illustrate how this has occurred, we have provided four representative examples of Chinese cities that have explored different approaches to promoting development of the real estate market to support urban infrastructure construction, and that have thereby accelerated urbanization. We have also noted the problems created by these models. We believe that the models described in this paper will help other countries fund their own development of urban infrastructure, while avoiding harmful effects on social and economic development.

2. Background and methods of analysis

China's central government implemented a residential housing reform in 1998, after which citizens were allowed to own houses rather than relying on housing provided by their employer, and implemented a land supply system reform in 2002, after which local governments were given the right to sell land or to lease land to citizens to generate funds for projects such as urbanization; the latter is the so-called "land finance model" (Chen et al., 2011; Wu et al., 2015). These reforms became the cornerstones of China's urbanization process because they led to the development of a real estate market and the reliance of local governments on the land finance model (Zheng et al., 2014). Although China's real estate market resembles western markets in terms of how prices respond to changes in demand, the land was originally owned by the government, not by citizens, and the market is managed by the government (Fung et al., 2010). Where land was already occupied by farmers or collectives, the government "bought" the land from them by providing compensation payments or other measures such as providing new housing elsewhere; unfortunately, the compensation was often far below the true value of the land. These policies have accelerated growth of the real estate market, leading to extremely high land and housing prices (Zhang et al., 2016). The cost of housing increased by an average of 7% annually since 1998, and the cost of land increased by an average of 23 % annually since 2002 (NBS, 1979-2018).

The money generated by this market provided the capital needed for urbanization and represents an essential important source of financial support for the construction of public infrastructure by China's local governments (Cai et al., 2019). The development of the real estate industry has provided the space required for production and living activities, housing, and commercial activities, and has created an important material foundation to support future development of urbanization (Yang et al., 2019). Therefore, understanding China's real estate market is the key to understanding the country's amazing urbanization process (Chen et al., 2019a).

China's real estate market has flourished since it first emerged (Zhang et al., 2016). Since 2000, real estate investment has accounted for about 20 % of total investment in fixed assets (Chen et al., 2017). The area of new buildings increased rapidly, from 0.3×10^9 m^2 in 2000 to 2.1×10^9 m^2 in 2017 (an increase of 7 times), and house prices increased from 2.1×10^3 RMB·m^{-2} to 7.9×10^3 RMB·m^{-2} (an increase of nearly 4 times) (NBS, 1979-2018). This market-oriented reform has improved the housing conditions of Chinese urban residents by replacing old buildings with a supply of new, modern buildings and expanding the built-up area of cities to allow the creation of new buildings in former farmland and unused land (Guan et al., 2018). At the same time, the improvement of standards of living has accelerated the construction of residential real estate (Wang and Liu, 2015). This, in turn, has promoted the development of the residential real estate market and accelerated the migration of the rural population to cities (Liu et al., 2012).

Overall, China has achieved impressive progress in urbanization (Cao et al., 2014), but nearly one-third of the country's population still lives in rural areas (Yuan et al., 2018). Providing urban homes for more of these people will require huge amounts of money to develop and maintain the necessary urban infrastructure. Therefore, one goal of our research was to examine current models of how China can raise these funds. This is also a hot topic around the world, so our discussion will provide inspiration for land managers in other parts of the world.

In the present study, we defined three research questions: What methods did China use to stimulate real estate development? How did real estate development raise funds for urbanization? What problems have been caused by these approaches? Due to the complex national conditions in a country as large as China, the development of each region has faced different constraints, leading to different solutions. We chose four cities with different but successful models to illustrate the diversity of solutions: stimulating the real estate demand by establishing an industrial park, increasing the value of land by replacing old low-density buildings with modern high-density high-rise buildings, providing bank loans to support buying of real estate, and government control of housing prices. Specifically, we considered the regional differences and important policies that have affected China's urbanization process. We selected an industrial park model in Suzhou, Jiangsu Province; renovation projects in Xi'an, Shaanxi Province; bank loans for real estate buyers in Zhuhai, Guangdong Province; and government price controls in Hangzhou, Zhejiang Province. Fig. 1 shows the locations of these cities. We obtained data to support our analyses from the Statistical Yearbooks of China for Jiangsu, Shaanxi, Guangdong, and Zhejiang provinces (NBS, 1979-2018). Based on this data and background, we describe how the four models have raised funds for urbanization, as well as their background, effects, contributions to urbanization, and problems.

3. Responses to a shortage of urbanization funds

3.1. Development of an industrial park in Suzhou

Suzhou Industrial Park is a typical industrial park, and is located in the eastern part of Suzhou City, in Jiangsu Province. In 2017, Suzhou Industrial Park achieved a GDP of 238.8×10^9 RMB and Suzhou City achieved an urbanization rate of 75.8 %, which is comparable to the average level for developed countries (NBS, 2018). During the city's rapid urbanization process, the industrial park project effectively stimulated real estate demand, which enabled the government to raise large amounts of funds for urbanization through land finance.

The industrial park model has created huge demand in the real estate market (Chen et al., 2019a). On the one hand, the local government implemented a series of measures to attract large numbers of enterprises to invest in the park; these measures included tax reductions and free or inexpensive rental of factory facilities. This greatly decreased the establishment, production, and operating costs of enterprises in the park and promoted the development of an industrial agglomeration. On the other hand, this industrial agglomeration created a large number of employment opportunities for workers who left rural areas to come to the city. From 2002 to 2017, the number of people employed in this industrial park increased from 167×10^3 to 774×10^3. During the same period, many more people immigrated to the park area than emigrated from the park area. The number of immigrants reached six times the number of emigrants in 2017 (Fig. 2a). This movement of people was driven by the number of jobs created by new or expanded industries, but these jobs were made possible by the increased supply of commercial real estate. The influx of people also created a huge demand for residential real estate.

The increase in demand for real estate has increased investment in real estate from 10.7×10^9 RMB in 2002 to 230.6×10^9 RMB in 2017 (Fig. 2b), an increase of more than 20 times. During the same period, the real estate price rose from 2.2×10^3 RMB·m^{-2} in 2002 to 14.9×10^3 RMB·m^{-2} in 2017, an increase of nearly 7 times (Fig. 2b). The booming real estate market encouraged real estate developers to buy land. As the sole seller of the land, the government can obtain land at a low price by providing compensation to its residents that is less
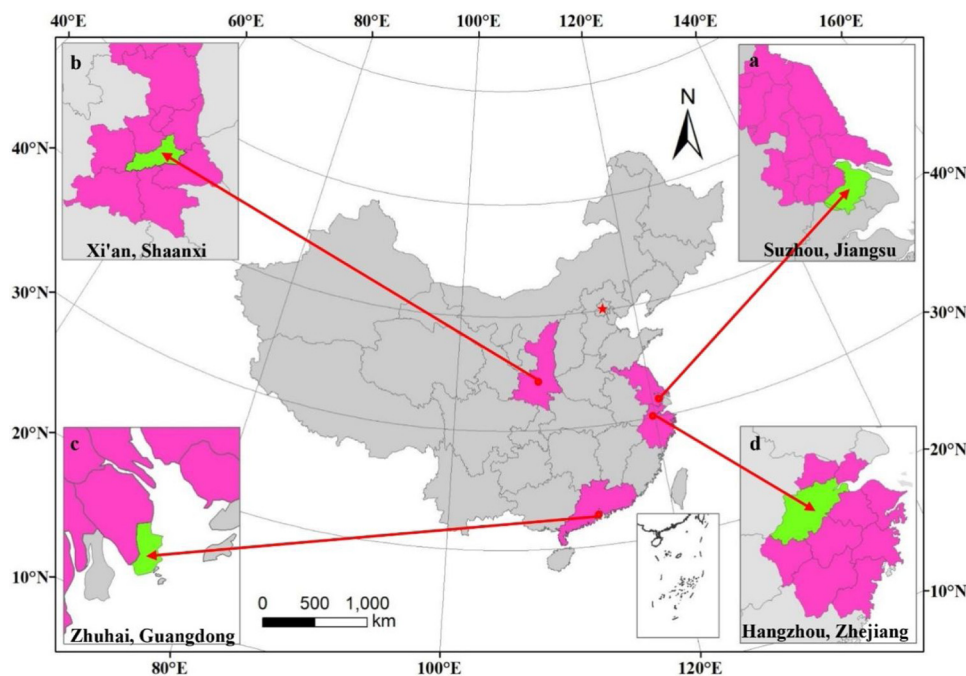
than the true value of the land, and can then sell the land to real estate developers at a high price (Cao et al., 2008). This "buy low, sell high" approach allowed the government to generate huge amounts of income from the land transfers. These revenues have been invested in urban infrastructure construction. For example, from 2002 to 2017, the length of urban roads increased from 1.2×10^3 km to 10.3×10^3 km, an increase of nearly 9 times, and the number of medical institutions increased from 1.5×10^3 to 3.2×10^3, an increase of more than 2 times (Fig. 2c).

This model of urban development has not only raised a large amount of money to support urban infrastructure construction, but has also enhanced well-being by greatly increasing the mean salary of workers through the creation of good jobs. From 2002 to 2017, the average annual wage of these employees increased from 22.7×10^3 RMB to 102.8×10^3 RMB, an increase of nearly 5 times. However, real estate prices have risen faster than wages, making much of the new real estate unaffordable to workers who moved to the city. These workers have been forced to share accommodations instead of owning or renting their own home. The resulting high population density will have adverse effects on resources, climate, and food security (Burnett, 2016). However, these problems are not inevitable if the government chooses to invest enough money to solve them, or implements other measures such as the price controls we describe in section 3.4.

3.2. Replacement of old buildings in Xi'an

Xi'an is an important and world-famous city in western China, and its urbanization rate reached 73.4 % in 2017. In 2007, Xi'an implemented a program to replace the city's old buildings, which were generally small and lacked conveniences such as plumbing, with more modern high-rise apartment buildings, thereby greatly increasing both the number of places to live and their quality. At the same time, they began a large-scale urban transformation project whose goal was to enhance the image of the city. The city renovated 33 residential areas during the "Twelfth Five-Year Plan" period (from 2011 to 2015), and planned the construction of 67 new residential areas during the "Thirteenth Five-Year Plan" period (from 2016 to 2020). These plans played a key role in promoting the urbanization process in Xi'an and improving the housing conditions for residents.

The smooth progress of the renovation has increased the value of

the local land (Shi et al., 2016). By demolishing the small original houses and replacing them with high-rise apartment buildings, the renovation project also freed up a large amount of construction land in urban areas with convenient access to transportation and high suitability for economic development. These conditions attracted a large number of buyers and merchants to invest in the city, leading to increased land prices. In addition, the land targeted by the renovation projects was mostly land that was communally owned by agricultural or industrial collectives before the transformation, and it became state-owned land after the renovation. This led to an increase in the price of the land. This transformation of land ownership laid a foundation for the government to raise urbanization funds through fees charged for the transfer of land from the state to new owners.

The resulting appreciation of land value has promoted real estate development by making the investment more attractive to developers. The real estate investment in Xi'an increased from 7.9×10^9 RMB in 2002 to 223.5×10^9 RMB in 2017, an increase of more than 27 times (Fig. 3a). This has enabled the government to tax these land transfers and obtain a large amount of funds to support urbanization. At the same time, the real estate price rose from 2.0×10^3 RMB·m^{-2} to 8.5×10^3 RMB·m^{-2}, an increase of more than 4 times (Fig. 3a). The development of the real estate industry has funded the construction of the urban infrastructure. For example, the length of urban roads has increased from 1.0×10^3 km in 2002 to 4.4×10^3 km in 2017 (an increase of more than 3 times), and during the same period, the green space increased from 68.73×10^6 m^2 to 359.36×10^6 m^2, an increase of more than 5 times (Fig. 3b).

The project to replace older buildings, which was designed to improve land use and add value to the land, was a conflict-free way to raise funds for urbanization. It not only promoted urban infrastructure construction in Xi'an, but also improved the living conditions of residents. However, the distribution of benefits from the land sales was unfair, since the residents of the former old buildings received improved accommodations, but did not share in the profits from subsequent sale of the land; thus, the distribution of benefits from these changes needs to be improved (He, 2012).

3.3. Bank loans for home buyers in Zhuhai City

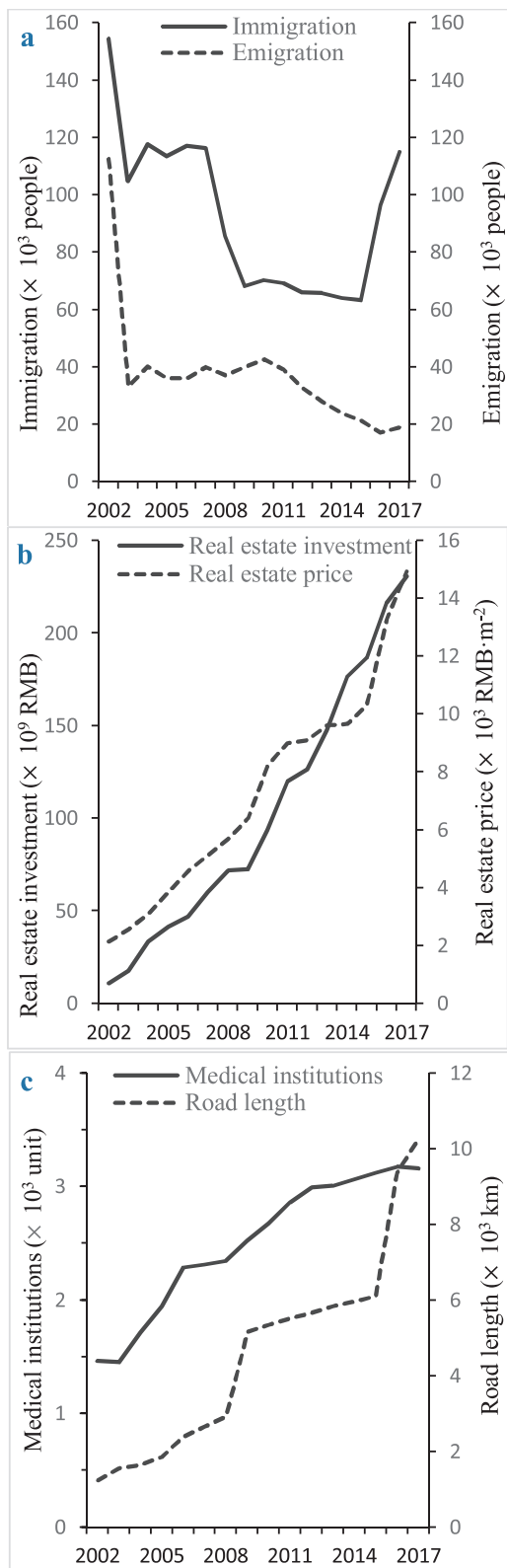Zhuhai City, in Guangdong Province, is a city in China's Pearl River

Fig. 2. Changes for the Suzhou Industrial Park from 2002 to 2017: (a) the number of people that immigrated to and emigrated from the park, (b) the total real estate investment and real estate price, and (c) the number of medical institutions and length of urban roads. Sources: National Bureau of Statistics (2003-2018), http://www.stats.gov.cn/.
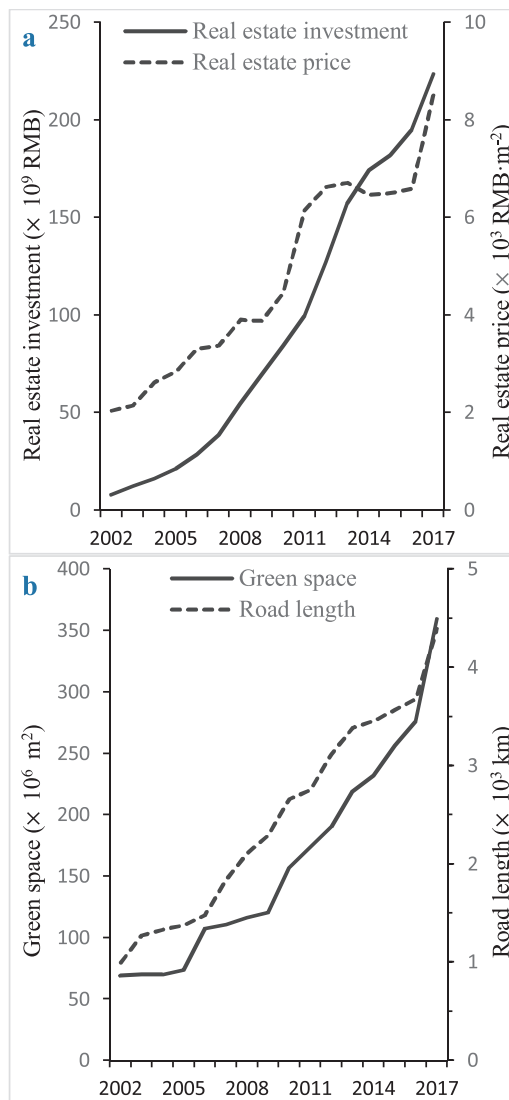

Fig. 3. Changes in real estate and infrastructure in Xi'an from 2002 to 2017: (a) the total real estate investment and real estate price, and (b) green space area and road length. Sources: National Bureau of Statistics (2003-2018), http://www.stats.gov.cn/ (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.).

Delta. Since China's "reform and opening-up" in 1978, Zhuhai's real estate market has developed rapidly as the city gradually became an economic and industrial center (Xian et al., 2019). The implementation of a mortgage loan policy has greatly increased the demand for home purchases, which were formerly difficult because residents had insufficient funds to purchase real estate without assistance (Xu and Chen, 2012). These loans brought Zhuhai's real estate industry into a period of rapid development. From 2003 to 2014, the total medium-term and long-term loans (loans with a period longer than 5 years) in Zhuhai increased from 21.3×10^9 RMB to 152.8×10^9 RMB, an increase of more than 7 times (Fig. 4a). During the same period, real estate prices rose from 3.4×10^3 RMB·m^{-2} to 13.7×10^3 RMB·m^{-2}, an increase of more than 4 times (Fig. 4b). The investment in real estate development increased from 3.9×10^9 RMB in 2002 to 38.8×10^9 RMB in 2014, an increase of nearly 10 times (Fig. 4b).

The prosperous real estate industry has become a pillar of Zhuhai's economic development. However, as housing prices continue to rise, the funds required to buy houses have also risen. In response, banks have provided loans to help consumers purchase houses, which is an effective way to solve the problem of insufficient funds for residents.
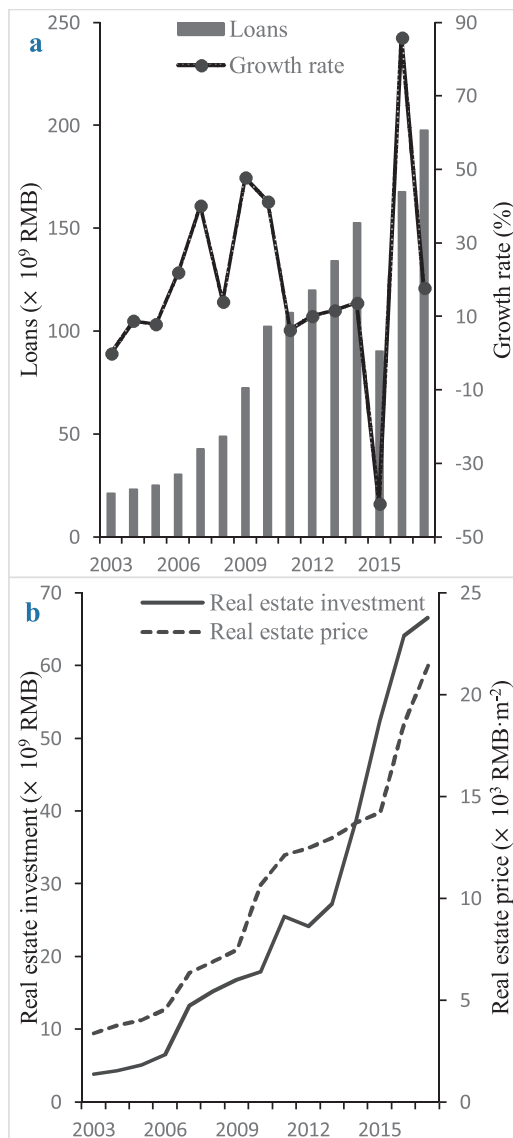
Fig. 4. Changes in the real estate market of Zhuhai City from 2002 to 2017: (a) medium-term and long-term loans and the growth rate of these loans, and (b) real estate investments and prices. Sources: National Bureau of Statistics (2004-2018), http://www.stats.gov.cn/.

Because the interest rates for these loans are fixed for the duration of the loan, short-term interest rate increases will not affect holders of current loans. However, for residents who are unable to completely pay off the loans before the end of the loan's term, there is a risk that future interest rates will make it impossible for them to afford the loan payments. This restricts the number of people in Zhuhai who can afford to buy a house based on a loan.

To mitigate this problem, the banks in Zhuhai City adopted an innovation in 2015 that had not yet been adopted by other banks to encourage loans: they reduced the minimum down-payment to 20 % of the purchase price (from a previous value of 30 %). This made it easier for residents to obtain a loan. However, because this increased the debt of these borrowers, any adverse change in their employment status will create a significant risk that they will be unable to afford the loan payments.

From 2015 to 2017, the average annual growth rate of housing sales was 17 %, which was 6 percentage points higher than the average growth rate between 2000 and 2014 (Fig. 4b). The increased demand for real estate purchases has driven a boom in the real estate market.

This, in turn, has attracted more residents to purchase real estate and increased the demand for loans (Davis and Zhu, 2011) and the total amount of medium-term and long-term loans (Fig. 4a). This has allowed more residents to purchase real estate despite the increasing prices (Acemoglu et al., 2015).

By providing loans to buy houses, banks increase the demand for real estate and promote the development of the real estate market. However, a development model based on bank credit is very susceptible to changes in lending policies (e.g., the minimum down-payment) and interest rates. If banks increase interest rates, they may harm the real estate market (Koetter and Poghosyan, 2010). To prevent this from becoming a problem, China should implement a prudent housing credit policy to ensure long-term stability that will promote the development of the real estate market while maintaining prices within a reasonable range. Because the government charges a land transfer tax when a purchased property is sold to someone else, this will ensure that real estate continues to raise funds for urbanization.

3.4. Government control of house prices in Hangzhou

Hangzhou, the capital of Zhejiang Province, is located on China's eastern coast. It is the political, economic, and cultural center of Zhejiang Province. After hosting the 2016 G20 summit, the city's image and popularity improved around the world (Tang and Wang, 2017). The real estate investment increased from 19.8×10^9 RMB to 260.7×10^9 RMB in 2016, an increase of more than 13 times (Fig. 5a). The real estate price increased from 3.5×10^3 RMB·m^{-2} in 2002 to 15.8×10^3 RMB·m^{-2} in 2016, an increase of more than 4 times (Fig. 5a).

To stabilize real estate prices, the Hangzhou Housing Security and Housing Authority implemented annual price control policies that limited price increases, applied purchase restrictions, and restricted sales in 2017. First, a strict price ceiling was established for each urban area of Hangzhou, and any property that exceeded the upper limit of the price could not be sold. The price limit also controlled the price of the parking spaces associated with each property. Hangzhou implemented three programs to restrict purchases and sales:

1. Every single resident holding a local household register is allowed to own only one residential property.

2. Residents who not holding household registration need to move in for two years with continuous social charity before they can purchase a house.

3. Corporate purchasers of real estate must also wait at least 3 years before re-selling their property.

In addition, the Ministry of Housing and Urban–Rural Development of Hangzhou has implemented differentiated price control policies that are adapted to the characteristics of each part of the city to make it easier for residents to purchase their first home.

Despite these constraints, the government's policy of controlling housing prices has created potential opportunities for increased real estate prices. From 2016 to 2017, before the price control policies were implemented, Hangzhou's real-estate prices grew rapidly throughout the year (Fig. 5b). By 2017, the real estate investment reached 273.4×10^9 RMB, an increase of 4.9 % since 2016. Meanwhile, the total sales of real estate reached 360.4×10^9 RMB, which was the highest value in China. After the price control policies were implemented, the prices stabilized in 2018, at an average growth rate of only 0.1 % per month (Fig. 5b). The government's ultimate goal of stabilizing real estate prices was to control speculation, but their policies clearly told potential purchasers that prices will rise at a stable rate rather than fluctuating widely. This increases confidence in the real estate market.

The increased real estate price has increased the land transfer income earned by local governments and provided an important source of funding for urbanization. For example, from 2002 to 2017, the length of urban roads increased from 1.3×10^3 km to 3.6×10^3 km, an increase
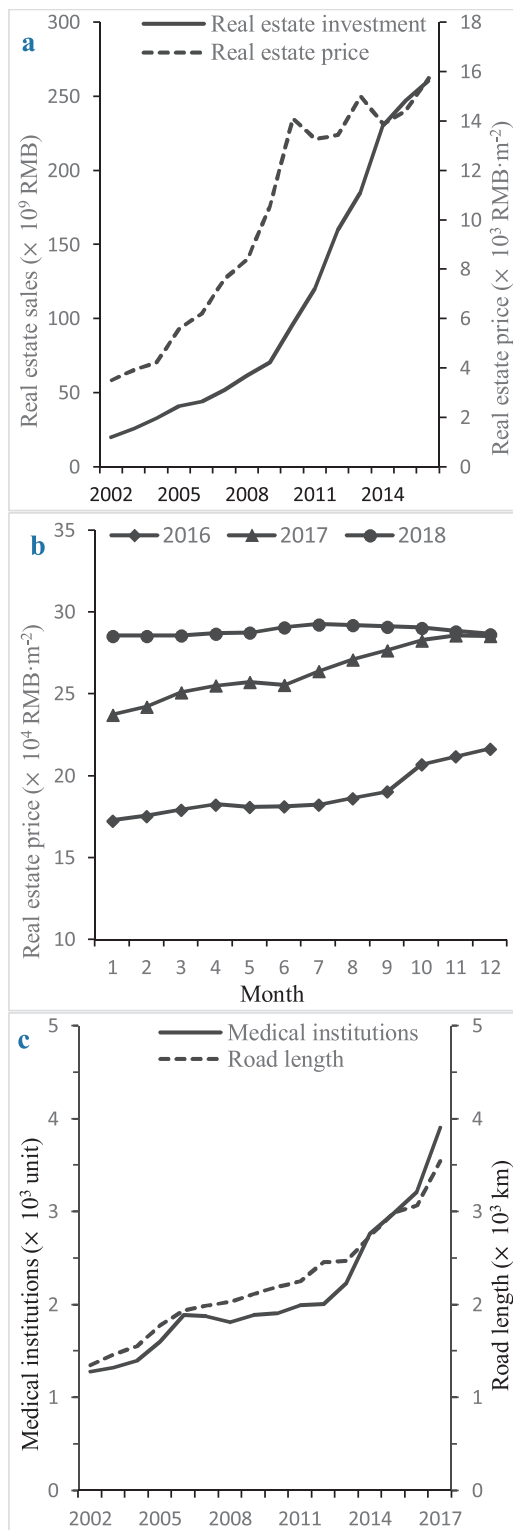
Fig. 5. Changes in the real estate market in Hangzhou from 2002 to 2016: (a) real estate investment and prices, (b) monthly prices from January to December between 2016 and 2018, and (c) the number of medical institutions and length of urban roads. Sources: National Bureau of Statistics (2003-2018), http://www.stats.gov.cn/.

of nearly 3 times, and the number of medical institutions increased from 1.2×10^3 to 3.9×10^3, an increase of more than 3 times (Fig. 5c). One key benefit of the constrained price increases that resulted from the government's control of housing prices is that this could potentially

prevent the real estate bubble that has developed in many other Chinese cities (Zhao et al., 2017). Therefore, when implementing housing price control, the government must fully consider the effects on development of the real estate market and on the expectations of future prices.

4. Discussion

The four cases described in this paper show how China found a source of funding for urbanization and the associated infrastructure construction through promoting development of the real estate market. China has stimulated demand for real estate by adopting a series of measures. First, Suzhou Industrial Park attracted corporate investment by adopting preferential measures for businesses, which attracted a large influx of labor and increased housing demand from the workers. Second, replacement of old buildings in Xi'an stimulated demand for real estate by transforming outdated small buildings into modern high-rise buildings in good locations. Third, Zhuhai City's bank lowered the minimum down-payment ratio for home buyers to allow more residents to purchase a home. Fourth, Hangzhou's government imposed controls on house prices to control real estate speculation, which reduced the burden on buyers and increased their ability and willingness to buy a house. The increased demand created by these four models has attracted large investments from real estate developers, as these changes made them more willing to buy land to develop as real estate. This contributed to a prosperous real estate market, while also earning large amounts of money for city governments through land transfer fees. The result has been growth in infrastructure investment and urbanization that was considerably more rapid than would have been possible without this income.

China's urban governments act as large monopolies that not only control a large amount of land capital but also have administrative power to control how the land is sold and used (Gao et al., 2017). This lets them buy land at low prices (e.g., by offering small compensation payments to former residents of the land), sell land at high prices, and generate a huge net profit through both the high sales price and the income from land transfer fees. The ability to take advantage of this monopoly power has provided a major source of funds for investment in urban infrastructure (Wu et al., 2015).

The development of China's real estate industry to promote urbanization has been a relatively conflict-free road. On the one hand, the development of real estate markets has allowed the government to raise funds for urbanization through the land finance model and use the funds to improve urban infrastructure construction. From 2001 to 2017, China's land transfer fees increased from 13.0×10^9 RMB to 83.8×10^9 RMB, an increase of more than 6 times (NBS, 2002–2018). On the other hand, the improvement of urban infrastructure attracted corporate investment, created new jobs, and led to an influx of labor, which, in turn, stimulated real estate development. China's investment in real estate development increased from 0.6×10^{12} RMB in 2001 to 11.0×10^{12} RMB in 2017, an increase of nearly 18 times. The land finance model of real estate development to promote urbanization is being implemented in most Chinese cities (Liu et al., 2012). Results such as those in the present study show that effectively stimulating the real estate market can increase a government's revenues to support the infrastructure development required to drive urbanization.

However, this approach is not sustainable. The main reason is that the available land resources are limited. When land resources are scarce, development of real estate will require the transformation of farmland into urban land, thereby causing a shortage of cultivated land and jeopardizing food security (Liu, 2018). At the same time, real estate prices will rise to high levels, and only the richest citizens will be able to afford housing (Guan et al., 2018). This will greatly slow real estate development. Local governments will lose an important source of income, resulting in a large and growing debt burden (Zheng et al., 2014). If an alternative source of funding is not found, this income shortfall will eventually threaten the urbanization process (Cai et al., 2019).

To ensure the sustainable development of urbanization, the Chinese government should take several measures to control the exploitation of land. First, the government should prioritize the protection of food security. Once farmland has been converted into non-agricultural land, the same amount of agricultural land must be created elsewhere to compensate for the loss of productive land, or advanced technologies must be adopted to increase agricultural productivity so that the remaining land can provide at least the same amount of food (Yep and Forrest, 2016). In addition, high-quality farmland should be protected against real estate development, since it is not always possible to replace this land (Vinge, 2018). Second, redevelopment of industrial land is an effective way to provide new land resources. This will require negotiations between current users of the land and the land's owner to determine when and how to redevelop the land for the proposed new uses; this will be particularly important for the industrial land used by state-owned enterprises under government control, which is often occupied by outdated industries that must be replaced or modernized (Gao et al., 2018). Third, price control mechanisms are also necessary. To support the development of appropriate mechanisms, local governments should implement rational and sustainable urban planning and transformation schemes to control the scale of real estate development (Ozarisoy, 2018). Fourth, the importance of urban–rural synergies must be considered during planning of the future urbanization process. The revitalization of rural areas will provide basic elements of urbanization such as labor, land, and capital, and because this will reuse existing developed land instead of developing new land, it can help to ensure sustainable urbanization (Long et al., 2010). This will also improve the balance among residents, the available land, and use of the land for industrial or commercial purposes, thereby revitalizing rural areas (Cheng et al., 2019).

Despite their drawbacks, the solutions described in this paper appear to be effective for supporting urbanization in the short term, and may provide inspiration for other developing countries that are seeking ways to improve urban development. In particular, the land finance model can address the problem of insufficient funds to support urbanization in most developing countries. The four Chinese models we described can both provide sufficient funds for urbanization and support economic development, provided that governments are aware of the problems we have described and take measures to mitigate or prevent those problems. We hope that these examples will stimulate other countries to adapt these models to be more suitable for their own social and economic contexts. As the world's largest developing country, China must recognize that its urbanization determines not only China's future, but also the world's overall urbanization. Although the land finance model is currently working well, China must prioritize a search for a more sustainable replacement and solutions to the risks we have described and to accomplish this, must seek alternative funding sources to sustain urbanization in the long term.

Author contribution statement

S.C. designed the research; Z.C. and Q.L. performed the data analysis and wrote the main manuscript text. All authors have reviewed the manuscript and approved it for submission.

Declaration of Competing Interest

The authors declare no conflict of interest. The opinions expressed here are those of the authors and do not necessarily reflect the position of the government of China or of any other organization. We consent to publish this article in your journal and to transfer copyright to the publisher once the paper has been accepted.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.landusepol.2020.104582.

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