

NBER WORKING PAPER SERIES

CHINA'S REAL ESTATE MARKET

Chang Liu
Wei Xiong

Working Paper 25297
<http://www.nber.org/papers/w25297>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2018

This article is a chapter prepared for “The Handbook of China’s Financial System,” edited by Marlene Amstad, Guofeng Sun and Wei Xiong. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2018 by Chang Liu and Wei Xiong. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

China's Real Estate Market
Chang Liu and Wei Xiong
NBER Working Paper No. 25297
November 2018
JEL No. R21,R28,R3

ABSTRACT

Since the 1990s, China's real estate market has experienced a dramatic and long-lasting boom across China. This boom has led to substantial concerns in both academic and policy circles that the rising housing prices might have developed into a gigantic housing bubble, which might eventually burst and damage China's financial system and economy. Motivated by this concern, this paper reviews the historical development of China's real estate market, describes the real estate boom, and discusses its links to households, local governments, firms and the financial system.

Chang Liu
Princeton University
Contemporary China Center
Princeton, NJ 08542
USA
liuchangsm@163.com

Wei Xiong
Princeton University
Department of Economics
Bendheim Center for Finance
Princeton, NJ 08450
and NBER
wxiong@princeton.edu

China's Real Estate Market

Chang Liu* and Wei Xiong**

The real estate market is not only a key part of the Chinese economy but also an integral component of China's financial system. In 2017, housing sales totaled 13.37 trillion RMB, equivalent to 16.4% of China's GDP. The real estate market is also deeply connected to China's financial system through several important channels. First, housing holdings are the biggest component of Chinese households' asset portfolios, partly due to a lack of other investment vehicles for both households and firms in China's still underdeveloped financial markets. Second, China's local governments heavily rely on land sale revenues and use future land sale revenues as collateral to raise debt financing through "Local Government Financing Platform" (LGFP). Third, firms also rely on real estate assets as collateral to borrow, and since 2007, firms, especially well-capitalized firms, have engaged heavily in acquiring land for investment purposes. Finally, banks are heavily exposed to real estate risks through loans made to households, real estate developers, local governments, and firms that are either explicitly or implicitly backed by real estate assets.

Figure 1 provides an estimate made by the Deutsche Bank Report (2016) of the exposure of China's banking system to the real estate market. Through the third quarter of 2016, property-related loans totaled 55 trillion RMB, accounting for about 25% of China's banking assets. Among these loans, mortgage loans to households accounted for 17.9 trillion, loans to real estate developers accounted for 14.8 trillion (including 7 trillion in regular loans, 6.3 trillion in credit through shadow banking, and 1.5 trillion through domestic bond issuance), and loans collateralized by real estate assets to firms and local governments accounted for 22.2 trillion. This heavy real estate exposure of banks makes the real estate market systemically important in China's financial system.

This article is a chapter prepared for "*The Handbook of China's Financial System*," edited by Marlene Amstad, Guofeng Sun and Wei Xiong.

* Princeton University and the Chinese University of Hong Kong, Shenzhen. Email: cl44@princeton.edu

** Princeton University and the Chinese University of Hong Kong, Shenzhen. Email: wxiong@princeton.edu

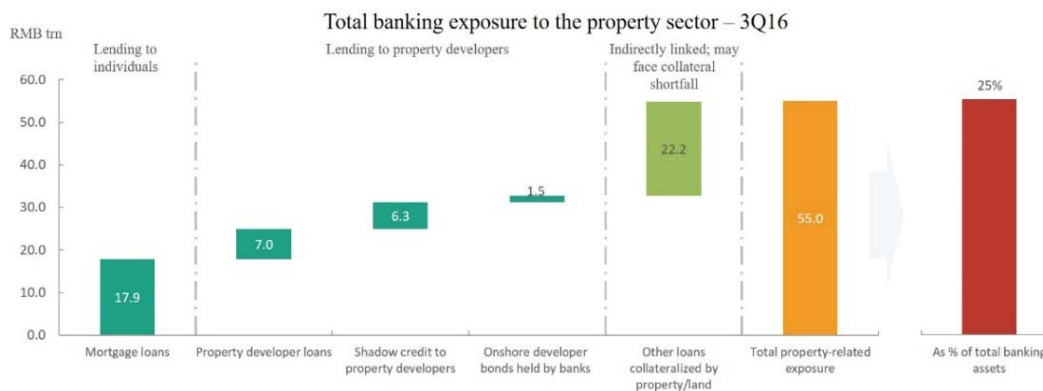


Figure 1: Exposure of China’s banking system to the real estate market

Source: Deutsche Bank Report (2016)

Since the 1990s, the real estate market has experienced a dramatic and long-lasting boom across China. This boom has led to substantial concerns in both academic and policy circles, e.g., Wu, Gyouko, and Deng (2016), Chen and Wen (2017), Glaeser et al. (2017), and Song and Xiong (2018), that the rising housing prices might have developed into a gigantic housing bubble, which might eventually burst and damage China’s financial system and economy. Motivated by this concern, this chapter reviews the historical development of China’s real estate market in Section I, describes the real estate boom in Section II, discusses how the real estate market is linked to households in Section III, how it is linked to local governments in Section IV, and how it is linked to firms in Section V. After covering these important aspects of China’s real estate market, in Section VI we discuss why we do not expect a sudden nationwide real estate crash in China, but highlight several key factors regarding the sustainability of the market going forward.

I. Development of China’s Real Estate Market

The development of China’s real estate market is deeply rooted in its great economic transition process. This section reviews several critical features of this development.

Housing reforms

China experienced a series of market-oriented housing reforms in the 1990s. Housing reforms were initiated in 1994 when the government allowed state sector employees to purchase full or partial property rights to their current apartment units at subsidized prices, which was essentially

welfare for state employees. In 1998, the Chinese government abolished this welfare housing system when it targeted the real estate sector as a new engine of economic growth in response to the adverse effects generated by the 1997 Asian Financial Crisis. After this reform, Chinese citizens working for the government or government-related organizations could no longer purchase housing at discount, unleashing a flood of private housing demand.

The privatization of housing has had profound impacts on the Chinese economy. Wang (2011) finds that by allowing households to increase their housing consumption, the reform laid a solid foundation for subsequent increases in housing prices. Other studies suggest that the dramatic transformation of housing from state-owned to private stimulated entrepreneurship in China by alleviating credit constraints, e.g., Wang (2012), and was associated with substantial increases in income inequality, e.g., Novokmet et al. (2018).

As an important impetus to the development of the private real estate market, in 1998 the People's Bank of China (PBC) outlined procedures for home buyers to obtain residential mortgages at subsidized interest rates. Moreover, between 1998 and 2002, the PBC lowered mortgage interest rate five times to stimulate private home purchases. By 2005, China had become the largest residential mortgage market in Asia. According to PBC reports, China's mortgage loans reached 17.9 trillion RMB in 2016, equivalent to 25% of the country's GDP that year. At the same time, the PBC also developed other policies to support the housing market, including broadening the scope of real estate loans and allowing pre-sales by developers. Taken together, the abolishment of welfare housing distribution, along with the introduction of residential mortgage loans, stimulated the take-off of China's great housing boom.

Urbanization process

China's urbanization process has traveled down a winding road. China had an overpopulated and poor agrarian economy when Deng Xiaoping initiated the Opening-up Reform in 1978. In order to ensure a stable food supply and maintain adequate public services to urban citizens, China used to have strict regulations on rural-to-urban migration, known as the *Hukou* system. This strict system not only distorted China's labor market but also dragged down the development of China's housing market.

China’s 10th Five-Year Plan, passed in 2001, set urbanization as a national strategy to stimulate demand and make the housing market a new engine of China’s economic growth. In accordance with this national strategy, the State Council issued a formal document that allowed free rural-to-urban migration for counties and small towns. The urban-rural divide in the *Hukou* system ended in 2014 when the State Council completely abolished the urban and rural dual structure for labeling Chinese citizens’ residence. Chinese citizens are now free to move to urban areas, except a small number of large cities such as Beijing and Shanghai. Figure 2 shows the steady growth in the urbanization rate from 1990 to 2016. Interestingly, urbanization is still in progress, with more than 40% of Chinese citizens still living in rural areas at the end of 2016. By depicting the completion of new homes in each year, Figure 2 also shows rapid increases in new home construction before 2012. Construction of new homes flattened out after 2012 and even dropped in 2015, indicating a slowdown in the construction boom.

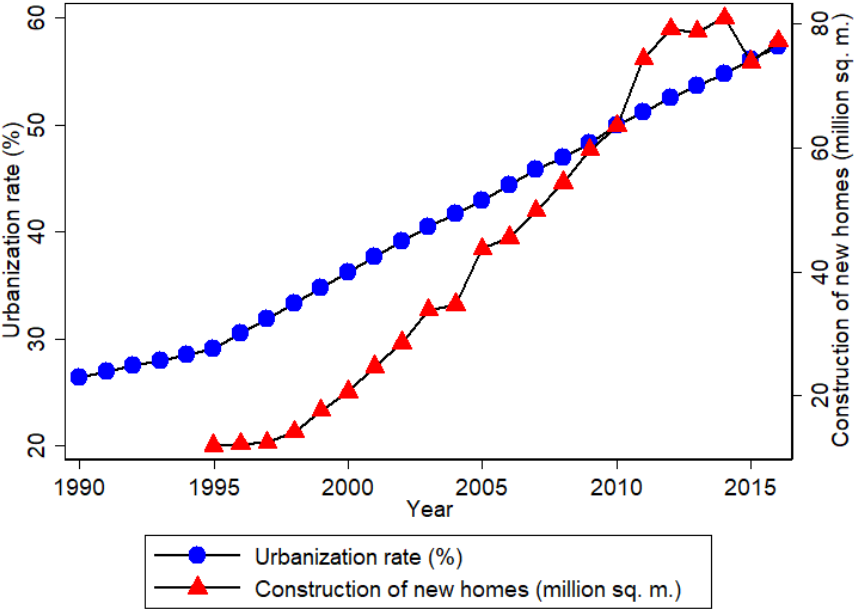


Figure 2: China’s Urbanization Process

Data Source: China’s National Bureau of Statistics.

In a recent study, Garriga et al. (2017) build a multi-sector dynamic general-equilibrium model to study the rural-to-urban structural transformation in China’s housing market. Their

quantitative analysis suggests that the urbanization process accounts for about 80% of the growth in China's urban housing prices.

Ghost towns

China's housing market development has been accompanied by a hotly debated phenomenon—the so-called “ghost towns”—as discussed by Shepard (2015) and Woodworth and Wallace (2017). One can often find newly constructed but mostly empty urban districts, usually in areas far away from traditional city centers. Well-known examples include Ordos in Inner Mongolia and Zhengdong New District in Henan Province. More generally, China's urbanization features a high vacancy rate in cities. According to data constructed for 36 cities by Glaeser et al. (2017), the housing vacancy rate rose sharply after 2009 across first-, second-, third, and fourth-tier cities, as shown in Figure 3.¹ This observation has led to serious concerns given that a high vacancy rate is commonly regarded as an indicator of a potential housing bubble.

Note that the massive urbanization process naturally leads to a high vacancy rate in the early stages of developing a new district. It is common for local governments across China to develop new districts on empty land far away from city centers. A typical development process starts with the local government outlining a master plan for commercial and residential properties to be built in the new district, along with supporting public infrastructure projects, such as roads, water and power plants, public schools, and hospitals. It may take several phases for a new district to become fully occupied and prosperous. In the first phase, the local government uses the master plan to attract developers to buy land and build commercial and residential properties in the district. It may take 1 to 5 years for the property and infrastructure projects to gradually start up. In this phase, the local government also starts the infrastructure projects. Property buyers start to acquire housing units in this early phase, mostly driven by investment interests, and the occupancy rate for completed residential properties is low. In the second phase, which may be 6 to 10 years after the launch of the new district, most of the construction is completed and the occupancy rate gradually

¹ Cities in China are typically classified into four different tiers according to their administrative ranking and economic importance. The widely accepted first-tier cities are Beijing, Shanghai, Guangzhou, and Shenzhen. The second tier is generally comprised of 2 autonomous municipalities (Tianjing and Chongqing), the capital cities of 24 provinces and 9 vital industrial and commercial centers. Lasha, the capital of Tibet, is typically excluded from the list due to its special economic status. All cities in the first and second tiers are national (or at least regional) industrial or commercial centers.

rises over time. It often helps if the local government moves some of its agencies and bureaus into the new district, which serves as a stimulus for commercial businesses, such as restaurants and shops, to move in with the state employees. It may take more than 10 years for the new district to become fully occupied. This marks the third phase—commercial businesses are in full operation and living conditions in the district become comfortable. Only at this time do commercial businesses in the district become profitable and a secondary housing market becomes active.

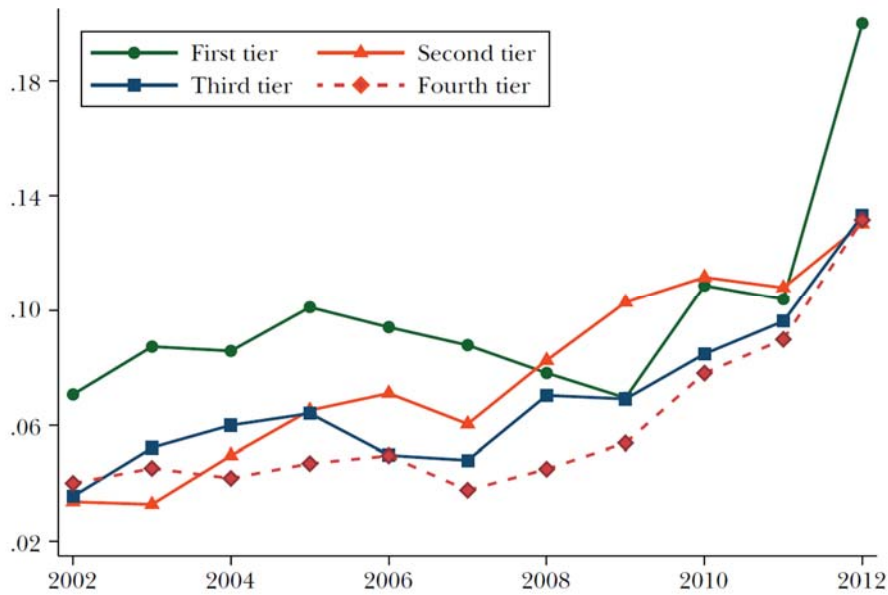


Figure 3: Vacancy Rates for Chinese Cities, 2001–2012

Source: Glaeser et al. (2017)

As a result of this long development process, it is not surprising to see a high vacancy rate in the first and second phases of a new district. Nevertheless, several factors may exacerbate the high vacancy rate and lead to ghost towns that remain unoccupied for prolonged periods. First, as we will discuss later, land sale revenues are an important source of local governments’ fiscal budgets. This distinct institutional feature may incentivize local governments to overdevelop new districts and real estate projects. Second, as part of the national urbanization process, small cities have experienced an outflow of residents to first- and second-tier cities.

There is an extensive body of literature on China’s ghost towns. Woodworth and Wallace (2017) characterize some stylized facts. Zhang, Jia, and Yang (2016) relate high vacancy rates in

Chinese cities to rising income inequality, measured by the income GINI index. Anglin et al. (2014) and Wang, Zhang, and Zhou (2018) show that the career concerns of local government officials, combined with China's land leasehold system and fiscal system, help to explain their outward development tendency (i.e., their preference to build new urban districts). The decentralized spatial distribution of Chinese cities can also be partially attributed to the fast development of China's infrastructure system, including urban railroad and highway systems, as argued by Baum-Snow et al. (2017).

II. The Real Estate Boom

Since its housing reforms in the 1990s, China has experienced a spectacular real estate boom that is still ongoing. This section discusses this boom.

Housing prices

One cannot simply use prices from housing transactions from one month to another to compute housing-price appreciation in a city because housing units transacted in two separate months are likely different and thus have different qualities. This feature makes housing transactions different from trading of typical financial securities. As a result, it is important to construct a housing price index that adjusts for potential quality heterogeneity in transacted housing units. There are two commonly used approaches to construct such housing price indices. One is the hedonic price regression approach, initially proposed by Kain and Quigley (1970), which regresses the prices of all housing transactions that occurred at different times in a given city on all measurable characteristics of the transacted housing units as follows:

$$\ln P_{i,t} = \beta_0 + \sum_{s=1}^T \beta_s \cdot I\{s = t\} + \theta_c X_i + \epsilon_{it}$$

where $P_{i,t}$ is the price of a housing transaction at time t , and X_i is a vector of characteristics of the transacted housing unit, such as distance to city center, area amenities, availability of public transportation, size of the unit, etc. After accounting for the price effects of housing quality captured by these measurable characteristics, the time-effect coefficients $\{\beta_t\}_{t=0}^T$ provide a housing price index of the city. A key challenge to this approach is that failure to include all relevant housing characteristics, some of which may be unobservable, may lead to a biased price

index. This challenge is particularly severe in China’s nascent housing market as the urbanization process has led to dramatic expansions of cities, making it extremely difficult to reliably measure housing quality.

In response to the challenges with the hedonic price regression approach, economists, e.g., Case and Shiller (1987), have developed a second approach based on repeated sales of the same housing unit. As repeated sales share the same housing quality, this approach does not require any direct measure of housing quality. A potential weakness of this approach is that it requires a sufficient number of repeated housing transactions, which is again difficult for many Chinese cities, as repeated housing sales usually become more frequent only after the housing market matures.

In a recent study, Fang et al. (2016) develop a hybrid approach to account for the unique setting of China’s nascent housing market. Specifically, they use housing transactions within the same housing communities. It has been common during China’s urbanization process for a developer to build up a community with hundreds of apartment units in a number of high-rise buildings and then gradually sell these apartments over 1 to 2 years. These apartments share the same community amenities, which are usually difficult to measure, and differ only in their characteristics inside the community, such as size, number of rooms, floor level, and orientation, which are relatively easy to measure. Based on this observation, Fang et al. (2016) construct a housing price index for 120 cities in China by modifying the standard hedonic regression approach to include a community fixed effect, which controls for the community-level heterogeneity, together with a number of within-community characteristics:

$$\ln P_{i,j,t} = \beta_0 + \sum_{s=1}^T \beta_s \cdot I\{s = t\} + DP_j + \theta_c X_i + \epsilon_{it}$$

where $P_{i,j,t}$ is the price of housing transaction i in community j , DP_j is a set of community fixed effects, and X_i is a vector of characteristics of the transacted housing unit within community j . The time-effect coefficients $\{\beta_t\}_{t=0}^T$ again serve as a housing price index of the city. They estimate this regression by using a detailed mortgage data set from a major commercial bank for 120 Chinese cities from 2003 to 2013, and create a housing price index for each of these cities. A recent study by Chen et al. (2018b) uses a similar approach and a mortgage loan sample from a different major commercial bank to create a set of housing price indices for 70 cities after 2011.

The National Bureau of Statistics (NBS) publishes housing price indices for 70 major cities. Before 2011, the NBS 70-city price indices show only small price appreciations across China, in contrast to casual observations about housing transaction prices in these cities.² After 2011, the NBS adopted a new housing price construction approach, which adjusts for housing quality according to document released on the NBS website. Interestingly, Chen et al. (2018b) confirm that after 2011 the NBS 70-city index has become more reasonable in reflecting housing price fluctuations. To discuss China’s housing boom, this chapter uses the housing price indices of Fang et al. (2016) to cover the period of 2003–2012 and use the NBS 70-city index to cover the later period of 2013–2017.

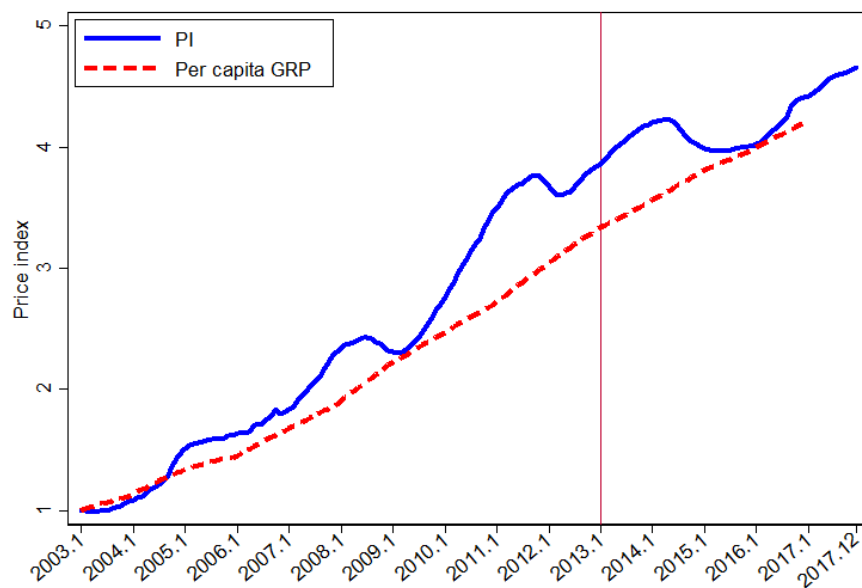


Figure 4: National Average Housing Price Index, 2003–2013

Notes: PI is weighted by urban population.

Source: Fang et al. (2016) and NBS.

Figure 4 depicts the monthly national average housing price indices (PI) from 2003 to 2017, which is weighted across cities based on urban population. The figure also shows a simple measure

² By comparing their price indices with the NBS 70-city price indices, Fang et al. (2016) find that the NBS 70-city housing price indices display substantial smaller price appreciations than theirs during the period of 2003-2013.

of households' purchasing power: per capita gross regional product (GRP), which is available up to 2016. The vertical line in the plot marks January 2013 that separates the two samples, with the housing price index from Fang et al. (2016) for the earlier period and the NBS 70-city index for the later period. The national housing price index level appreciated tremendously, reaching in 2017 a level about 4.5 times of its 2003 level. Interestingly, this tremendous housing price appreciation was nonetheless accompanied by similar growth in per capita GRP.

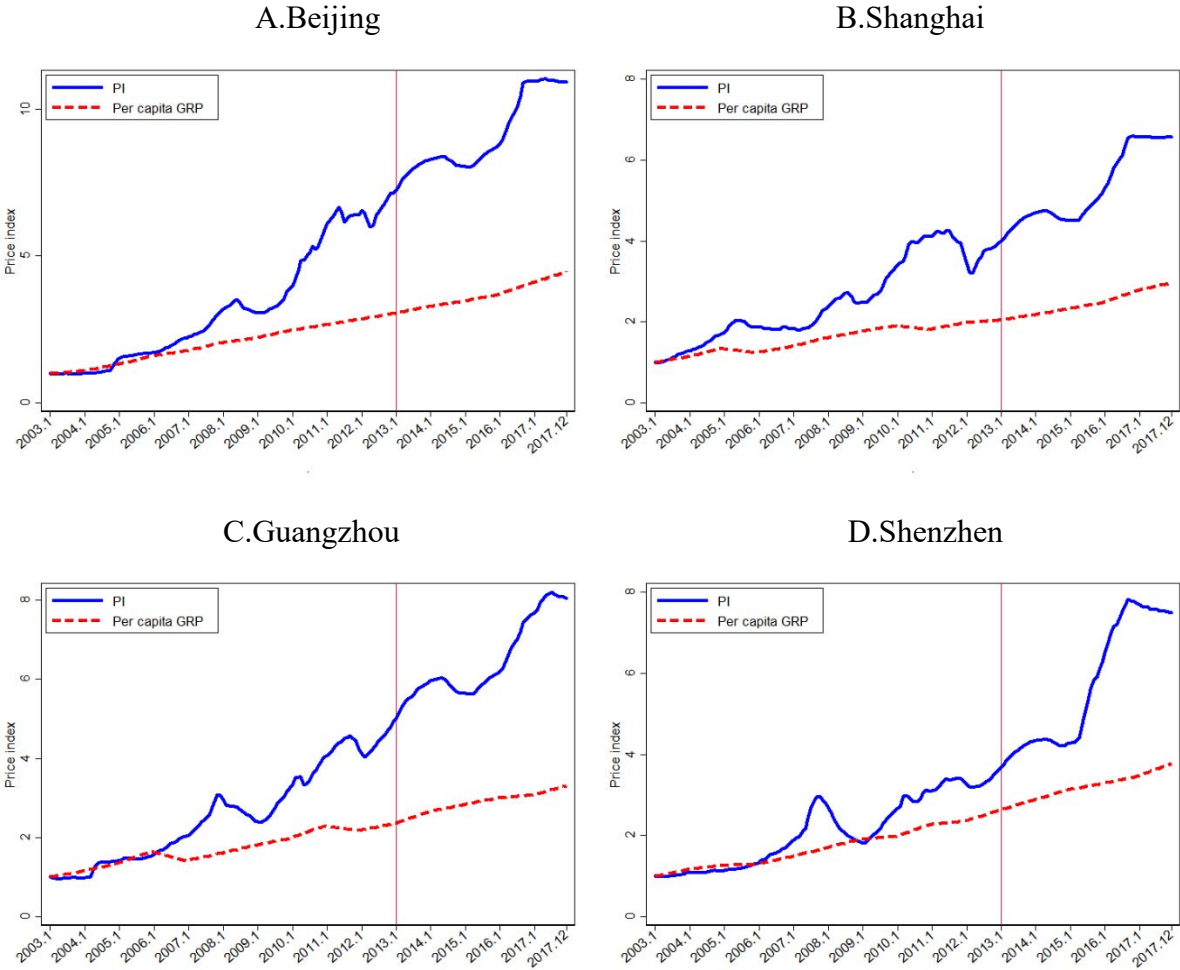


Figure 5: Housing Price Indices for China's First-Tier Cities

Source: Fang et al. (2016) and NBS.

Figure 5 depicts in four separate panels the housing price indices for the four first-tier cities, Beijing, Shanghai, Guangzhou, and Shenzhen. In Panel A, the housing price index of Beijing experienced an enormous increase from an index level of 1 in 2003 to over 11 in 2017, an eleven

fold increase in just 14 years. This increase is also substantially greater than the increase in per capita GRP of the city, which was about fourfold. As seen in Panel B, the housing price index of Shanghai registered a more modest, but nevertheless enormous, increase of 6 times of the initial level in the same period.

Panels C and D display the housing price indices for Guangzhou and Shenzhen, which are both located in the Pearl River Delta of Guangdong province, one of the most vibrant manufacturing centers in the world. These two cities had similar housing price fluctuations in 2003–2017. While the overall price appreciation in this period is remarkable, both cities experienced multiple episodes of price adjustment, with the most-severe price adjustment occurring in 2007–2008. The 2008 world financial crisis had a great impact on the export industries in this region, and both cities suffered substantial housing price drops in this period, with the housing price index of Shenzhen dropping by more than 30%.

Figure 5 also shows remarkable price increases across the four first-tier cities in 2015–2016, with the housing prices in Shenzhen almost doubled, before the prices in these cities stabilized at their new levels in 2017 as a result of the government’s effort to temper any further increases.

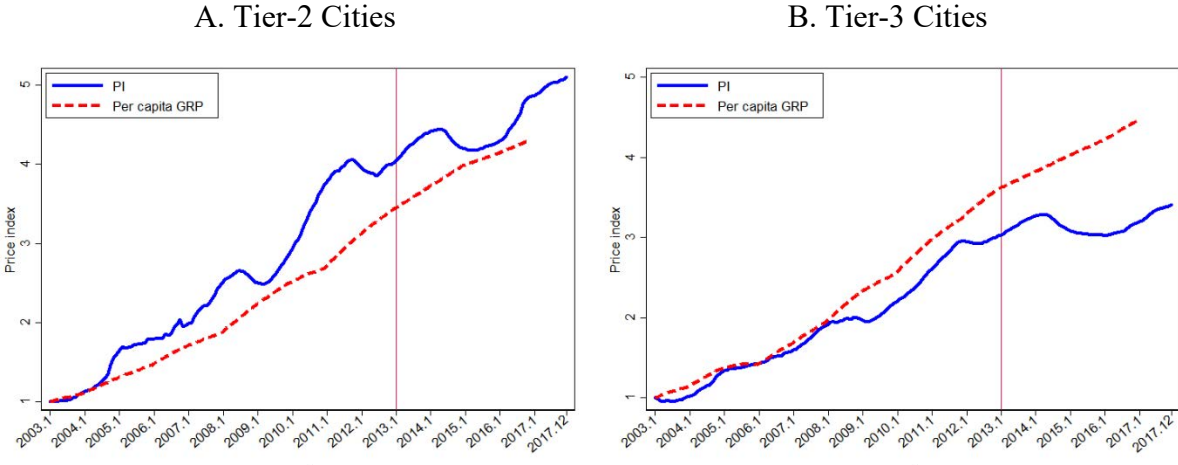


Figure 6: Housing Price Indices for China’s Second- and Third-Tier Cities

Notes: PI is weighted by urban population.

Source: Fang et al. (2016) and NBS.

Figure 6 reports the average housing price indices for the second-tier cities and the third-tier cities in Panels A and B, respectively. Panel A shows that the second-tier cities, which are typically provincial capitals and important commercial centers, had an enormous housing price appreciation of 400% from 2003 to 2017. This price appreciation while more modest than that of the first-tier cities, is spectacular by any standard. Even more impressively, it was accompanied by neck-in-neck growth in the per capita GRP. Panel B shows that the third-tier cities, which are usually regional industrial or commercial centers, had a price appreciation of over 200% in the same period.³ While this price appreciation is impressive, it actually lagged behind the growth of per capita GRP in these cities.

In sum, housing prices across China experienced tremendous appreciation from 2003 through 2017. These enormous price appreciations were accompanied by equally impressive growth in per capital GRP, except in a few first-tier cities.

Is there a housing bubble?

The world financial crisis in 2008 was originated from the crash of the U.S. housing market. Interestingly, from 1996 to its housing market peak in 2006, the national housing price index in the U.S., as measured by the Case-Shiller U.S. housing price index, grew by about 100%. In contrast, the national housing price index in China appreciated by about 250% from 2003 through 2013, and further appreciated after 2013. This tremendous housing price appreciation across China has led to a widely held concern that there might be a housing bubble in China, e.g., Wu, Gyouko, and Deng (2016), Chen and Wen (2017), Glaeser et al. (2017), and Song and Xiong (2018).

This is a challenging issue due to the well-known difficulty of reliably measuring the fundamentals of a housing market, which are determined by complex dynamics of both supply and demand of housing in an uncertain macroeconomic environment. The rapid economic growth and urbanization process in China make assessment of its housing fundamentals even more challenging. To confront this challenge, Han, Han, and Zhu (2018) develop a dynamic rational expectations general equilibrium model to quantify the fundamentals of Beijing's housing market. Based on the balanced growth path of the model and using Hong Kong as a reference city, their

³ Note that Panel B builds on two samples of third-tier cities. The sample before 2013 includes 85 third-tier cities from Fang et al. (2016), while the sample after 2013 includes the third-tier cities in the NBS 70-city housing price index.

analysis shows that the fundamentals are 30% lower than the observed market prices, suggesting the presence of a potential housing bubble. Despite its rigor, their model nevertheless has to ignore potentially important features, such as migration and housing demand from non-residents, which play particularly important roles in the housing market of first-tier cities in China.

The fact that the enormous housing boom across China was accompanied by similarly impressive growth in household purchasing power at the national level shows that this is not a boom without any fundamental support. As argued by Fang et al. (2016), this is also in contrast to the housing boom and bust cycles experienced by Japan in the early 1990s and Singapore in the late 1990s, which both witnessed housing price appreciations substantially greater than household purchasing power.

The recent U.S. housing crash directly damaged the U.S. financial system through heavy mortgage defaults, due to insufficient down payments required by banks during the boom years. As we will discuss in the next section, it is reassuring that banks in China have imposed strict down payment requirements of over 30% on all mortgage loans, which protect banks against a sizable housing market meltdown of 30%. However, as we will also discuss, a key worry is that many households across China, especially low-income households, have taken on substantial financial burdens to buy homes at 8 to 10 times their annual incomes. Their buying decisions cannot be explained by simple consumption motives, and instead build on expectations of high income growth being persistent into the future. Such expectations make the housing market particularly vulnerable to a sudden economic slowdown in China, which could lead to dramatic corrections in household expectations about future income growth and housing price appreciation.

Land prices

Land is a crucial input in housing development. In many other countries, such as the United States, land supply for housing in a city is determined by the landscape and local zoning restrictions. In contrast, land supply in Chinese cities is determined by land sales of local governments, as land is legally owned by the State and controlled by local governments. For a long time after the establishment of the People's Republic of China in 1949, land transactions were prohibited. An important milestone occurred in 1988 when China amended its constitution to allow land transactions, which set the legal stage for privatization of housing. However, strictly speaking,

the object of a land transaction is the “land usage right” of a land parcel for a period of time rather than its ownership.

China has rigid zoning restrictions to classify different land parcels for different uses, with industrial land for building industrial and manufacturing facilities, residential land for residential properties, and commercial land for commercial and business facilities. Under the current land law, industrial land can be leased for a term of 30 years, commercial land for 40 years, and residential land for 70 years. It is commonly presumed by the public that after a lease period expires, the property owner would be able to renew its land lease, possibly at a fee, although land renewal and the renewal fee are not formally stated by the land law.

Similar to housing transactions, heterogeneity in land quality makes it difficult to compare prices in different land transactions. A recent study by Chen et al. (2018a) uses the standard hedonic price regression approach to construct a set of land price indices for 284 Chinese cities, based on information released by the Ministry of Land and Resources on all land transactions in these cities between 2004 and 2015. Their land price indices separate industrial, commercial, and residential land in each city.⁴

Figure 7 depicts the national land price indices for industrial land, commercial land, and residential land, which are weighted averages of the city level land price indices across the 284 cities used in Chen et al. (2018a). The plot shows that commercial land experienced enormous price appreciation, from a level of 1 in 2004 to over a level of 6.11 in 2015. Residential land had a more moderate, yet nevertheless dramatic appreciation, from a level of 1 to a level of about 4.75 over the same period. In contrast to the substantial price appreciation of residential and commercial land, the price of industrial land remained almost flat, from a level of 1 in 2004 to a level of about 1.5 in 2015. It is a common practice for local governments throughout China to offer industrial land at subsidized prices to support local industries. As industrial enterprises can often obtain industrial land at low cost to start or expand their operations in a city, industrial land did not experience as much price appreciation as commercial and residential land.

⁴ See also Deng, Gyourko, and Wu (2012) for a study of land prices in China.

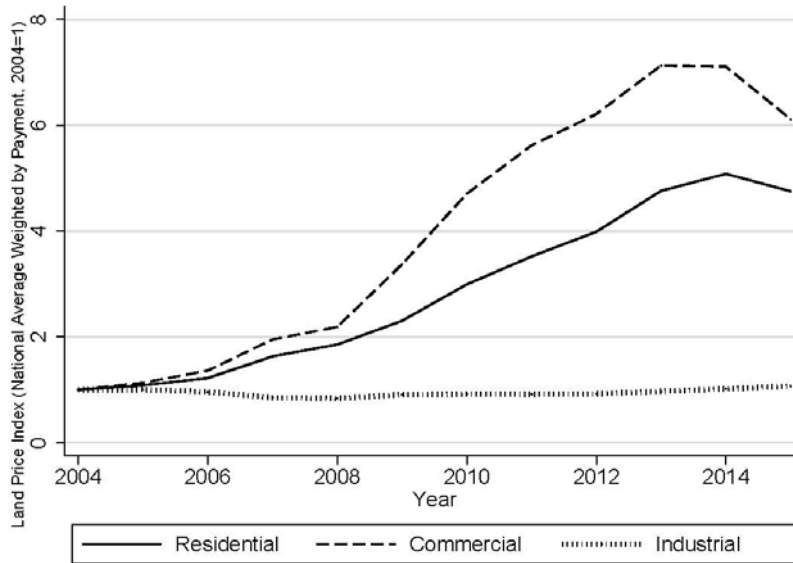


Figure 7: Land price index for different types of Land Sales in China

Data Source: Chen et al. (2018a)

As we will discuss in Section IV, the revenue from land sales is an important source of local governments' fiscal budgets. To the extent that local governments are local monopolies of land supply and heavily rely on land sale revenues for their own fiscal budgets, the markets for residential properties and commercial real estate are crucially tied to land sale policies and strategies of local governments. This is a special feature of China's real estate market.

III. Real Estate and Households

Housing is the largest item on households' balance sheet. According to a household survey by the China Economic Trend Research Institute, housing assets accounted for 66% of household wealth in 2016.⁵ Household demand is also a key element in housing market fundamentals, motivating a strand of the academic literature to analyze the relationship between China's housing boom and household finance. Wang and Zhang (2014) show that a host of fundamental factors, including the urban *Hukou* population, wage income, urban land supply, and construction costs, are unable to explain the housing price growth in Chinese cities between 2002 and 2008, which

⁵ Data Source: *Survey Report on China's Household Wealth, 2017*, edited by China Economic Trend Research Institute of the Economic Daily.

suggests the presence of other missing factors. Cao, Chen, and Zhang (2018) show that households' investment demand can be this missing factor, and it is particularly relevant for wealthy families with relatively loose financial constraints. Zhang (2017) argues that the marginal buyer in China's housing market is liquidity constrained, which in turn helps explain the substantially higher returns in housing as opposed to returns from capital market investments. Along a reverse direction, several studies, e.g., Chamon and Prasad (2010), Wei and Zhang (2011) and Yang, Fan, and Zhao (2018), highlight that the housing boom also helps to explain China's high saving rates and low consumption.

In this section, we discuss the financial burdens faced by households, especially low-income households, in buying homes. Specifically, we want to understand whether housing has been out of reach for typical households in China, which worries many commentators, and whether households purchase housing for pure consumption purposes. Understanding these issues help to dissect the risks in China's real estate market from the household side.

Fang et al. (2016) analyze a sample of mortgage loans issued by a major commercial bank across 120 Chinese cities in 2003–2013. While wealthy households may not need mortgage loans to purchase homes, mortgages are necessary for many households, especially low-income households. In this section, we discuss several important observations uncovered by their study about home purchases of mortgage borrowers.

Down payment

Down payments are an important buffer that protects banks against the potential default risks of mortgage borrowers in the event of a future housing market meltdown. The analysis of Fang et al. (2016) shows that down payments in their mortgage sample had been consistently above 30% across first-, second-, and third-tier cities. Interestingly, they find that the average down payment ratio of mortgage loans made to the group with income in the lowest 10% of all mortgage borrowers was even slightly higher than that of the group with income in the middle quintile of all mortgage borrowers.

These high down payment levels are consistent with the strict mortgage policies imposed by the PBC on banks: one housing unit cannot be used as collateral for more than one mortgage loan. More importantly, mortgage policies require a minimum down payment of 30% on first mortgages.

This minimum down payment requirement had changed over time from between 30% and 40%. The adjustment of the minimum down payment ratio has even become a powerful instrument for the central government to intervene in the housing market. Down payments on mortgages used to purchase second homes are even higher.

The high mortgage down payment levels in China are in sharp contrast to the popular use of zero down payment loans and negative amortization loans during the U.S. housing bubble of 2000s,⁶ and mitigate the risk of mortgage defaults in the event of a future housing market meltdown. Furthermore, mortgage loans in China are all recourse loans, which allow lenders to collect a borrower's other assets in the event of a mortgage default. These institutional arrangements make a U.S.-style subprime credit crisis less of a concern for China.

Income of mortgage borrowers

Fang et al. (2016) provide a detailed account of household income of mortgage borrowers in the bottom 10% and middle 10% of all mortgage borrowers in each year between 2003 and 2013 and across first-, second-, and third-tier cities in their sample. They find steady growth in the household income of these two groups of mortgage borrowers, consistent with the rapidly rising household income during this period in China. More interestingly, they also map the average income of the bottom-income group of mortgage borrowers into the income distribution constructed by the Urban Household Survey, which is available for all first- and second-tier cities. They find that despite rapid housing price appreciation across China, the position of the bottom-income group of mortgage borrowers in the income distribution of city residents remained below the 35th percentile in first-tier cities and below the 40th percentile in second-tier cities throughout 2003–2013. This suggests that the rapidly growing prices did not exclude households in the low-income fraction of the population from buying homes.

Price-to-income ratio of mortgage borrowers

⁶ According to Mayer, Pence, and Sherlund (2009), during the U.S. housing bubble period of 2003–2006, households with poor credit (the subprime and Alt-A households) had commonly secured mortgages with a 5% or zero down payments to finance their home purchases. Some mortgages even allowed the borrowers to have negative amortization over time. When U.S. housing prices started to decline after 2006, these borrowers were more likely to default on their mortgage loans, exacerbating the housing market decline.

Price-to-income ratio provides a convenient measure of the financial burdens endured by a household in acquiring a home. Figure 8 depicts the price-to-income ratio of mortgage borrowers in the bottom-income and middle-income subsamples from Fang et al. (2016). The financial burdens faced by the bottom-income group are particularly relevant. In this group, the price-to-income ratio started at a level slightly above 8 across the three tiers of cities in 2003. In first-tier cities, this ratio remained at around 8 before 2008 and then climbed to a peak of 10.7 in 2011 before dropping back to 9.2 in 2012. In second- and third-tier cities, this ratio was very similar and remained in a tight range around 8. It had a modest decline from a level slightly above 8 in 2003 to 7.2 in 2007 and then climbed back to a peak slightly below 9 in 2011 before dropping back to around 8 again in 2012.

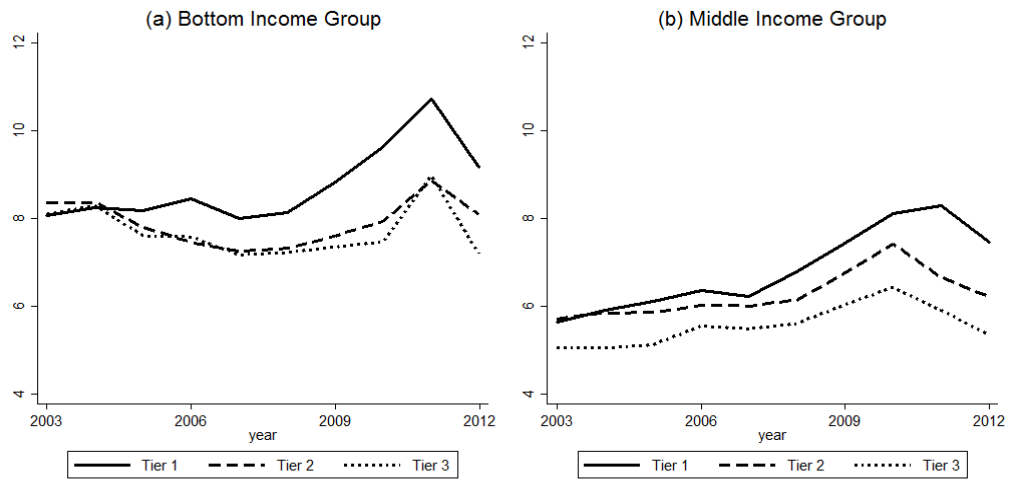


Figure 8: Price-to-Income Ratio of Mortgage Borrowers

Data Source: Fang et al. (2016)

The price-to-income ratio for the middle-income group was consistently lower than that for the bottom-income group. It was highest in the first-tier cities and lowest in the third-tier cities. Across the three tiers of cities, it had a similar pattern over time. In first-tier cities, it expanded from 5.6 in 2003 to 8.3 in 2011 before dropping back to 7.5 in 2012. In second-tier cities, it expanded from 5.7 in 2003 to 7.4 in 2010 before dropping back to 6.2 in 2012. In third-tier cities, it expanded from 5.0 in 2003 to 6.4 in 2010 before dropping back to 6.2 in 2012.

While the housing price appreciations in China are generally compatible with household income growth, Figure 8 shows that home buyers endure substantial financial burdens in buying homes. To clearly understand the financial burdens, let us consider a household that buys a home at eight times its annual income. A typical down payment of 40% implies that the household needs to save 3.2 years of its income before buying the home. In China, it is common for parents to pay the down payment for a young couple. In addition, the household needs a mortgage loan of 4.8 times of its income. Even if the loan comes with a modest interest rate of 6% and a long maturity of 30 years, each year the household would spend nearly 44.8% of its annual income to service the mortgage, including 28.8% to cover the interest payment and another 16% to pay down the loan at a linear schedule over 30 years.

Consumption motives cannot explain the willingness of these households to endure such financial burdens of buying homes. According to the data provided by the Housing Big Data Research Program of China's Social Science Academy, the annual rental yields of housing in Beijing and Shanghai were only 1.85% and 2.51% in July 2018,⁷ which are even below the yield of China's one-year Treasury bonds. In other words, renting homes is substantially cheaper than buying homes.

What makes those bottom-income mortgage borrowers willing to endure the enormous financial burdens? Several factors may help explain their willingness. First, China has a substantially higher saving rate relative to developed countries. According to data released by China's National Bureau of Statistics, the ratio of aggregate savings by households and firms relative to the national GDP was around 35% in the 1980s and gradually grew to over 50% in the 2000s. Second, China's relatively underdeveloped financial markets offer few investment assets for households and firms to invest their savings. The stringent capital controls imposed by the central government also prevent them from investing their savings in global financial markets. As a result, housing is often used as an investment asset, not just a consumption good. Third, to make matters worse, the largely unbalanced gender ratio between boys and girls in China means that boys face substantial competition in the marriage market. As home ownership serves as an

⁷ For the data source, see the following website: <http://zfdsj.org/report/shownews.php?lang=cn&id=80>.

important status symbol, the competition in the marriage market adds to demand for housing, as argued by Wei, Zhang, and Liu (2012).

Housing market expectations

With housing as an investment asset, expectation plays an important role in driving households' willingness to pay 8–11 times their annual income to buy homes. Two compelling forces may have led to high expectations for housing price appreciation. First, after observing China's breakneck economic growth of 10% each year on average for 40 years, it was tempting to believe that China's economy and household income would continue to grow at a high rate, even if not 10%, for a prolonged period. This kind of expectation would make the high housing prices appear more affordable. Suppose that a household expects its income to grow at an annual rate of 10% for 5 years. Then, its income would rise to 1.61 times the initial level, and an initial house price at 8 times of its annual income would fall to below 5 times its income after 5 years. Such expectations make the housing market particular vulnerable to any sudden slowdown of the economy, which may knock down households' growth expectations, which in turn may lead to a substantial contraction in the price-to-income ratios that they are willing pay for homes.

Another force also may have contributed to households' housing expectations. Given the importance of the real estate sector in China's economy and the significant contribution of land sales to local governments' fiscal budgets, a crash in the housing market would damage the macro economy and disable local governments. These severe consequences may have led to a perception that the central government would do whatever it could to avoid a housing market crash. In this sense, the housing market is "too important to fail" and enjoys implicit guarantees of the central government. In support of this perception, the central government has indeed used a broad set of instruments, as summarized by Fang et al. (2016), such as mortgage interest rates, mortgage down payment requirements, credit policies to real estate developers, and purchase restrictions on non-residents, to implement counter-cyclical intervention policies in the housing market. Zhu (2016) argues that this perception of implicit government guarantees has strongly encouraged risk-seeking behaviors in the housing market.

IV. Real Estate and Local Governments

China's local governments are deeply engaged in the real estate market. On the one hand, they directly control land supply. On the other hand, land sale revenues serve as an important source for local governments to fund their fiscal budgets and local infrastructure projects. Furthermore, since the world financial crisis in 2008, local governments have commonly used the LGFP to raise debt, either implicitly or explicitly by collateralizing land reserves and future land sale revenues. This section discusses the local governments' strong reliance on the real estate market.

Land Sales

Under the Chinese constitution, all land in China belongs to the State. In 1998, the 15th National Congress of the Communist Party of China passed a statutory bill granting local governments de jure ownership over land in their geographical jurisdictions. The Land Management Law passed in 1998 also authorizes local governments to sell usufruct rights over the land in their jurisdictions. Land transactions between local governments and private buyers constitute the primary land market. Private buyers who obtain usufruct rights through a leasehold from local governments can also sell the leasehold to a third party in the secondary land market. However, compared to the primary land market, the size of the secondary land market only accounted for 3.75% of all land transactions in terms of payment from 2000 to 2015.

Two fiscal reforms in the 1990s enhanced local governments' reliance on land sale revenues: the Tax-sharing Reform in 1994 and the Budget Law enacted in 1995. Before 1994, China's intergovernmental financial relationship could be characterized as a "fiscal contracting system." In this fiscal contracting system, the central government relied on local governments as its tax agencies and also gave them discretionary power over expenditures. Continuous declines of the total budgetary revenue as a fraction of GDP and the central government's share in the total budgetary expenditures eventually threatened the stability of China's macro economy. Zhu Rongji, the powerful Vice Premier at the time, strongly advocated the Tax-sharing Reform in 1994, which steered a greater share of the total budgetary revenue to the central government.

Figure 9 depicts the shares of subnational governments' budgetary revenue and expenditures from 1985 to 1998. There is a remarkable drop in the share of subnational governmental revenue after 1994, indicating that China's intergovernmental fiscal system moved into a new era with the

central government taking a substantially greater share of the budgetary revenue. Although the central government provides intergovernmental transfers to remedy the gap between local governments' revenue and expenditures, the Tax-sharing Reform managed to extract a larger portion of fiscal revenue from local governments, especially from those rich provinces. Kung, Xu, and Zhou (2009) and Han and Kung (2015) argue that the changing fiscal incentives might have caused local governments to shift their efforts from fostering industrial growth to “urbanizing” China, for instance, by developing the real estate and construction sector.⁸

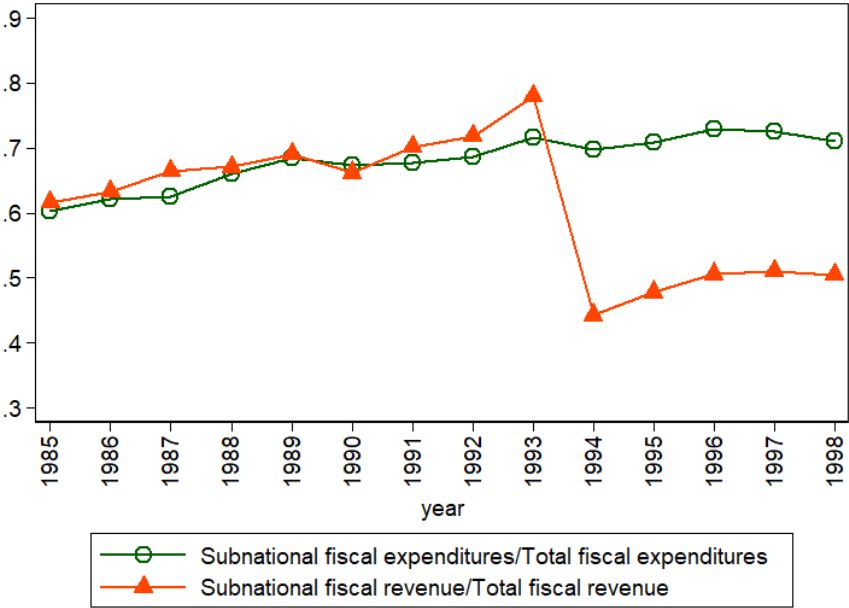


Figure 9: Shares of Fiscal Revenue and Expenditures of Subnational Governments, 1985–1998

Data Source: *Public Finance Statistic Yearbook in Fifty Years of China*, edited by the Ministry of Finance

Another reason for local governments' deep engagement in the real estate market is the Budget Law enacted in 1995, which prohibited local governments from running budgetary deficits or obtaining external financing. This has been widely viewed as a critical step in confining the soft budget constraint problem between local governments and the state-owned bank branches under their control. Facing these constraints, local governments managed to greatly expand their fiscal

⁸ Zhang, Fan and Mo (2017) also document that local governments' controls of residential land supply enlarged the impact of productivity shocks on housing prices.

capacity after the late 1990s by relying on non-budgetary funding sources such as land sales. Figure 10 depicts the revenue from land sales from 2002 to 2015 for three tiers of cities, with Panel A displaying the total land sale revenue and Panel B displaying its share in the local fiscal revenue. Total land sale revenue experienced rapid growth and reached a peak for the first- and second-tier cities in 2013. There is non-negligible heterogeneity in the share of land sale revenue in the total local fiscal revenue across cities, with this share particularly high for second-tier cities, which in some years reached over 40%.

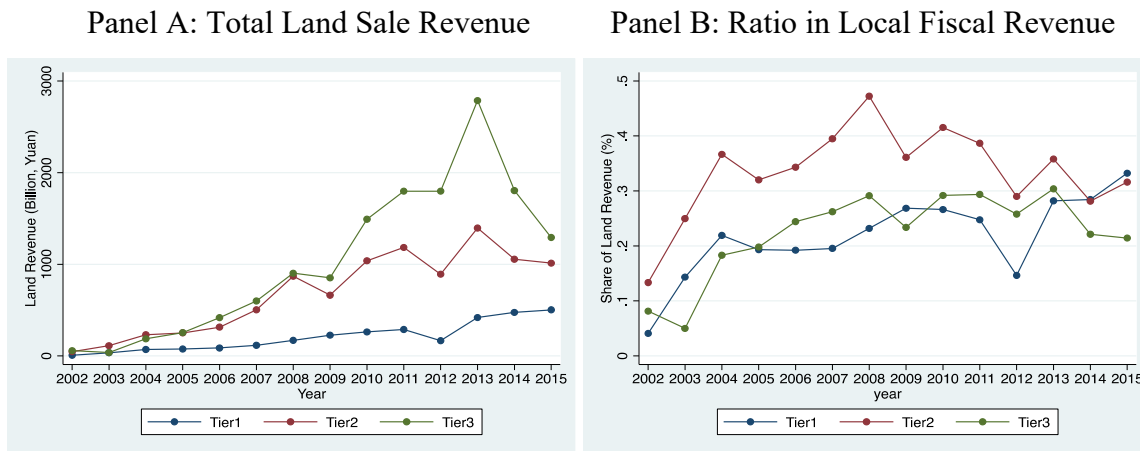


Figure 10: Land Sale Revenue for China's Local Government in 2002–2015

Data Source: China Municipal Statistical Yearbook and China National Land Resource Yearbook, various years

Tying local government budgets to revenue from land sales is a novel mechanism design. Given the initial conditions of underdevelopment across Chinese cities in the early 1990s, local tax revenue was far from enough to fund large capital-intensive infrastructure projects and other local business developments. The great uncertainty also discouraged banks from funding such projects, even if local governments were allowed to directly raise debt financing. On the other hand, like equity prices, land prices paid by buyers are determined not only by current business conditions in a city but also their expectations of future conditions. Conditional on the fact that the local government is able to use its revenue from land sales to improve local infrastructure and business environments, land prices can be substantially higher than what is justified by current conditions, much like high-flying IPO prices for high-tech firms without any past earnings. As local governments need to regularly sell land to the public to fund their future budgets, they are incentivized to implement those promised infrastructure projects and improve local business

environments. Thus, this is an incentive-compatible design, much like staged VC financing.

In addition to its function as fiscal revenue, land is also an important instrument for local governments to attract prominent firms who will pursue projects in their cities and support local industrial policies. Land (especially industrial land) is often given out for free, as a land grant, or sold at a discount to promising firms in high-priority industries. As we discussed earlier, this is a key reason that industrial land has substantial lower prices than commercial land and residential land. Local governments may also supplement the land grant with an additional tax allowance or funding support. In return, local governments benefit from future tax revenues from these supported firms or from an improved business environment and industry structure in their regions.

Cheung (2008) views discounts in land sales as a main tool for local governments to compete for businesses. Discretion in giving such discounts can lead to both excessive competition and corruption. Several studies, e.g., Cai, Henderson, and Zhang (2013), Chen and Kung (2016), Cai, Wang, and Zhang (2017), and Chen and Kung (2018), analyze corruption in China's land market. To restrict local governments' discretionary power in the land market, the central government stipulates the lowest price for industrial land and the lowest investment intensity for specific industries for different levels of cities and counties, generally according to their development levels and geographic locations. To restrain corruption, in 2002 the Ministry of Land and Resource issued the No. 11 regulation "Regulation on the Transaction Method of Leasehold Sale of Land by Local Government," which requires leasehold sales for commercial and residential developments to use open auctions. As a result of this regulation, the proportion of land transactions using open auctions, instead of case-by-case negotiations, rose from less than 20% in 2000 to over 90% in 2012.⁹

Finally, land sales by local governments are subject to a restrictive national quota constraint, which serves to protect necessary land for agricultural production at the national level and to discipline local governments' short-term incentives to overdevelop local real estate markets. The central government allocates the national quota across different regions, based on its macroeconomic policies and national development strategy. In recent years, China's Great Western Development Strategy has tilted more of the quota to central and western provinces, at

⁹ Data Source: Annual Report of China's Land Resources edited by the Ministry of Land & Resources, various years.

the expense of eastern provinces. Liang, Lu, and Zhang (2016) show that this shift in land supply raised housing prices and wages in eastern provinces, which in turn distorted the spatial distribution of China's economic activities.

Local government debt

Land and future land sale revenues also serve as key collaterals for local governments to raise debt financing. As we discussed before, China's Budget Law prohibited local governments from seeking debt financing. Bai, Hsieh, and Song (2016) provide a detailed account of how this regulatory arrangement was changed in 2008. To back stop the potential spillover effects of the world financial crisis on China's export-driven economy, in 2008, China launched a massive fiscal stimulus program on the magnitude of 4 trillion RMB, equivalent to 12.5% of China's GDP. This stimulus program involved mostly infrastructure projects, which local governments implemented and financed. It was infeasible for local governments to fund this massive program through regular tax revenue or land sales in a short time period. Instead, the central government allowed local governments to create the LGFP to raise debt.¹⁰

Another chapter in this handbook by Zhang and Xiong (2018) provides a detailed account of the arrangement of LGFP. Briefly speaking, in a typical arrangement to support a certain infrastructure project, a local government creates an LGFP and injects land reserves or future land sale revenues as capital into the LGFP, which in turn can apply for bank loans. In most cases, the LGFP also carries either explicit or implicit guarantees from the local government. These guarantees further mitigate any concern about credit risk. Local governments commonly use this arrangement at all administrative levels; this led to tremendous growth in debt taken on by local governments after 2008.

China's National Audit Office conducted a comprehensive audit of all local government debts at the end of June 2013. According to this audit, the total volume of outstanding local government debt reached 10.89 trillion RMB, equivalent to 19.2% of China's national GDP in 2013. Among these debts, 37.23% used future land sale revenue as collateral. Figure 11 provides the distribution

¹⁰ Regarding debt financing by LGFP, Ang, Bai, and Zhou (2016) find that real estate GDP is the most important determinant of the cross-section of excess yields of Chengtou bonds (i.e., bonds issued by LGFP to finance local infrastructure projects).

of local government debt across several dimensions. LGFP are the most important vehicles for local governments to raise debt, and governments have explicit obligations to pay 61% of the debts. Furthermore, bank loans were an important source of outstanding local government debt in 2013, and city construction is the most important purpose for raising the debts.

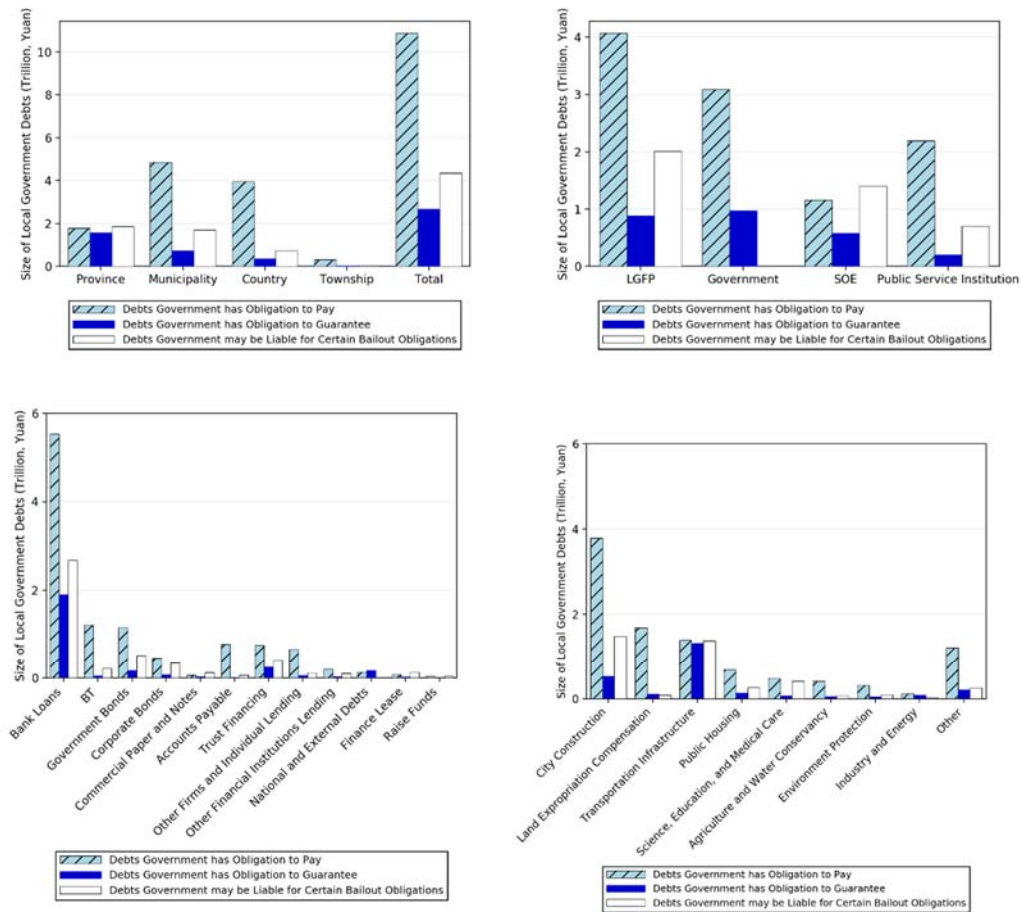


Figure 11: Size of Local Government Debt by Categories

Data Source: Audit Report on China's Local Debt

While LGFP helped to successfully implement the post-crisis stimulus program and fund many important infrastructure projects, their popularity has led to undesirable impacts on the financial system. Bai, Hsieh, and Song (2016) argue that the LGFP arrangement reversed important progress made by China's previous economic reform to constrain the soft budget constraint problem of local governments. Furthermore, when the central government later

tightened monetary policy to limit debt accumulation by local governments, LGFP had trouble rolling over their bank loans. Instead, this trouble pushed most LGFP debt financing into the shadow banking system with higher borrowing costs and less transparency. Consistent with this migration of local government debt into the shadow system, Chen, He, and Liu (2017) find that provinces with an abnormally higher increase of bank loan growth in 2009 experienced more shadow banking activities during 2012–2015.

V. Real Estate and Firms

Firms in China are also heavily exposed to risks of the real estate market. There are at least two key channels that expose firms to the real estate market. First, real estate assets are the most widely used collateral for firms to borrow from banks. As shown by Figure 1, banks have 22.2 trillion in outstanding loans with real estate as collateral, including loans to firms. Through this collateral channel, as modeled by Kiyotaki and Moore (1997), fluctuations in land price affect bank credit available to firms, which may in turn affect firm investment. Gan (2007) and Chaney, Sraer, and Thesmar (2012) provide evidence of this effect of land price fluctuations on firm investment in Japan and the United States, respectively. There are also several recent studies of this effect in China. Wu, Gyourko, and Deng (2015) use a unique firm data set in 35 Chinese cities in 2003–2011 but find no evidence of increases in firm investment in response to land price increases. Chen et al. (2018a) employ a larger sample of firms in 284 prefectural cities in 2000–2015 and find some supportive evidence.

There is also another speculative channel through which firms actively seek real estate exposure during China’s ongoing real estate boom. To discuss the speculative channel, we build on a recent study by Chen et al. (2018a), which analyzes the investment of a sample of non-financial and non-real estate firms publicly listed in China’s A-share market. Figure 12 depicts the average investment of these firms in each year between 2000 and 2015. The annual investment is further decomposed into four components from top to bottom: investment unrelated to land and investments to acquire residential land, commercial land, and industrial land. Firms’ annual investment rapidly rose from about 100 million RMB in 2000 to the peak of nearly 1,500 million RMB in 2011, before dropping to around 1,200 million RMB in more recent years. While these firms did not spend anything on land before 2007, they quickly expanded their land investments

after 2007. At the peak years of 2010 and 2011, a firm spent on average around 500 million RMB on acquiring land; this was mostly commercial land rather than industrial land. In 2010, commercial land accounted for more than 30% of the firms' net investment. While the amount and the share of land investment dropped after 2011, they nevertheless remained substantial in 2012–2015.

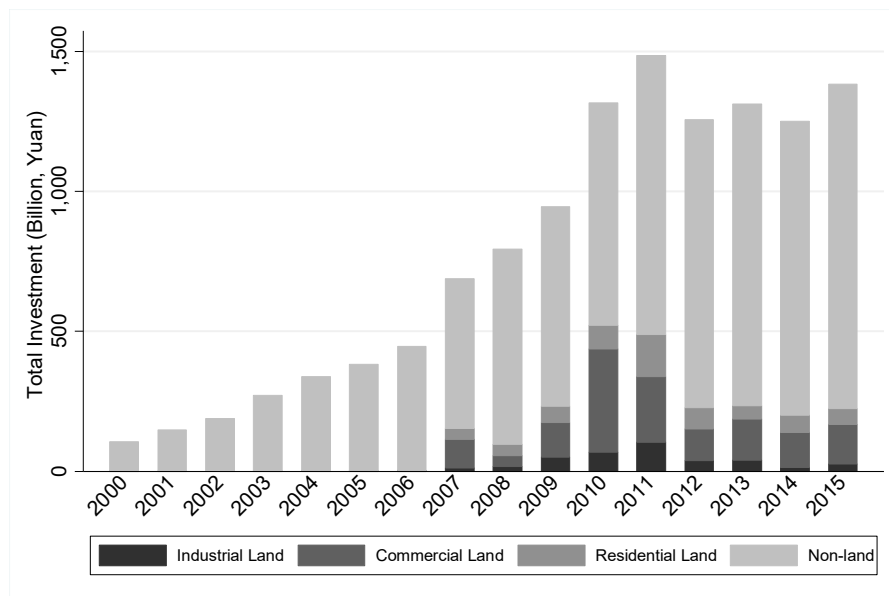


Figure 12: Investment of Publicly Listed Firms in China

Date Source: Chen et al. (2018a)

As these firms cannot build industrial and manufacturing facilities on commercial and residential land, Chen et al. (2018a) argue that the investment of these firms on commercial and residential land represents a form of real estate speculation, induced by the higher capital returns from land price appreciation than from the real economy during the real estate boom. Through a similar mechanism, Li and Wu (2014) and Shi (2017) argue that the real estate boom in China discouraged entrepreneurial activities.

VI. Challenges

The real estate market is an integral part of China's financial system and has systemic importance to the Chinese economy. Real estate assets contribute the most to households' balance

sheets and are the most important form of collateral firms and local governments use to raise debt financing. Even more special in China, local governments control land supply through regular land sales and at same time heavily rely on revenue from land sales to fund their own fiscal budgets and local infrastructure development. Furthermore, banks are heavily exposed to real estate through all sorts of loans either directly or indirectly connect to real estate.

There are substantial concerns both inside and outside China about the stability of China's real estate market. While we have discussed various imperfections of China's real estate market, we do not expect a sudden, nationwide real estate crash. First, China's economic miracle over the last 40 years and the unfinished urbanization process laid a solid foundation for the real estate market on the demand side. While some households are heavily in debt, the household sector as a whole has experienced rapid income growth. Second, China's banking system is generally healthy and well-protected by the strictly imposed down payment requirement of over 30% on all mortgage loans. Third, in the foreseeable future, China is likely to continue its capital control policies, which helps to keep the accumulated household wealth in the real estate market. Finally, concern regarding the impact of China's real estate market on the sustainability of China's local government finance is tempered by the fact that with annual fiscal revenues of over 8 trillion yuan and land sale revenues of about 3 trillion yuan, local governments have sufficient cash flow to cover the interest payments of their debts. According to estimates provided by Bai et al. (2016) on 1,800 LGFP, their total assets, mostly land reserves, amount to 70 trillion yuan, which is 50% more than their liability. It is thus unlikely that local governments in China will become illiquid or insolvent in the near future, unless China experiences a dramatic land price adjustment.

That being said, we must discuss several challenges facing China's real estate market. In the next few years, the central government will face a tremendous challenge in using its macro policies to manage the real estate market. Glaeser et al. (2017) discuss a delicate tradeoff: on the one hand, the Chinese government cannot afford to let the construction boom continue because more homes are being built in "wrong places" with lower, rather than higher, household income and such over-construction will eventually lead to a housing bust. On the other hand, the government cannot stop the construction boom without slowing down the economy and causing distress to China's employment rates. While we are not as pessimistic as Glaeser et al. (2017) about the inevitability of a housing bust in China, we are nevertheless sympathetic to the government's macroeconomic

policy dilemma: how to temper the housing boom to maintain long-run stability while addressing the short-term pressure that would be caused to the overall economy by a slowdown of the real estate sector.

In the medium term, local governments need to find a more sustainable mechanism to fund local fiscal budgets. One possibility is property tax levied on real estate assets as is common in many developed countries. In 2011, China conducted policy trials to levy property tax on second homes in Shanghai and Chongqing. The central government hesitated to expand this property tax program to other cities due to resistance from homeowners as well as the fear that it might lead to a real estate crash and eventually threaten the stability of China’s financial system. With previously sold land leaseholds gradually reaching their maturities, the subsequent land renewal process provides a natural point for local governments to start collecting additional fees or taxes on real estate properties.

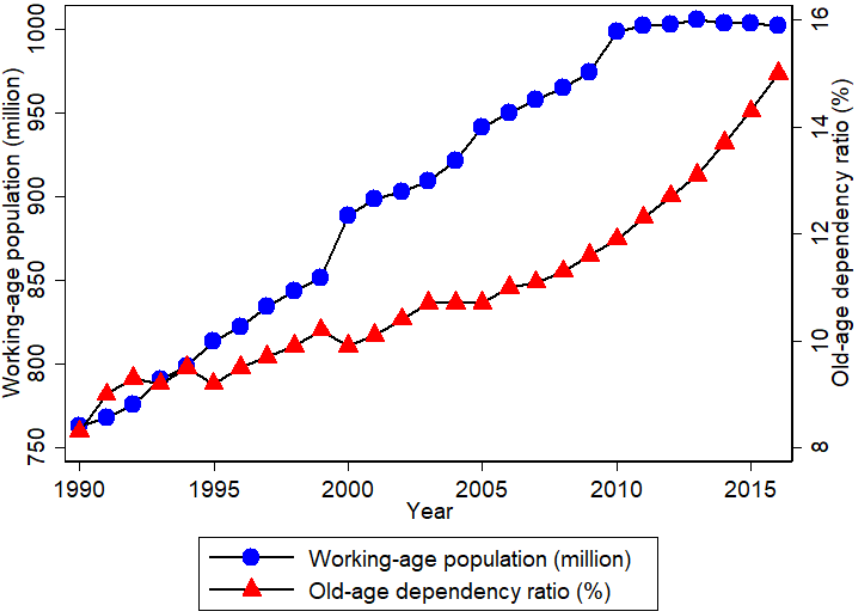


Figure 13: Structure Change of China’s Demography

Notes: Working-age is defined as 15–65 years old.
 Data Source: China’s Bureau of Statistics

In the long run, China’s real estate market faces a tremendous challenge from the rapid aging of its population. China started the “One-Child Policy” in the early 1980s. This policy has

substantially changed China's population structure by reducing the number of children born to each couple. Forty years after the start of this policy, China is beginning to see a serious aging problem in China. Figure 13 depicts China's working-age population along with the old-age dependency ratio (i.e., the ratio of older people in the full population) from 1990 to 2016. China's working-age population reached to its peak in 2014 and has started to decline, while the old-age dependency ratio has substantially grown from 8.3% in 1990 to 15% in 2016. With this trajectory, China will inevitably become an "old" society. This aging population will put great pressure on the demand for housing in the long run because houses currently owned by the older generation will be eventually transferred to the current younger generations, which are smaller. In 2016, the Chinese government officially replaced the One-Child Policy by a Two-Child Policy, which allows each couple to have two children. While this new policy will help to eventually improve the population structure, its effect is unlikely to be felt quickly enough to avoid the housing market pressure induced by the aging population.

References

- Ang, A., Bai, J., & Zhou, H. (2016). The great wall of debt: Real estate, political risk, and Chinese local government credit spreads. Working paper.
- Anglin, P. M., Dale-Johnson, D., Gao, Y., & Zhu, G. (2014). Patterns of growth in Chinese cities: Implications of the land lease. *Journal of Urban Economics*, 83, 87-107.
- Bai, C. E., Hsieh, C. T., & Song, Z. M. (2016). The long shadow of China's fiscal expansion. *Brookings Papers on Economic Activity*, 2, 129-181.
- Baum-Snow, N., Brandt, L., Henderson, J. V., Turner, M. A., & Zhang, Q. (2017). Roads, railroads, and decentralization of Chinese cities. *Review of Economics and Statistics*, 99(3), 435-448.
- Cai, H., Henderson, J. V., & Zhang, Q. (2013). China's land market auctions: Evidence of corruption? *The Rand Journal of Economics*, 44(3), 488-521.
- Cai, H., Wang, Z., & Zhang, Q. (2017). To build above the limit? Implementation of land use regulations in urban China. *Journal of Urban Economics*, 98, 223-233.
- Cao, Y., Chen, J., & Zhang, Q. (2018). Housing investment in urban China. *Journal of Comparative Economics*, 46(1), 212-247.
- Case, K. E., & Shiller, R. J. (1987). Prices of single-family homes since 1970: New indexes for four cities. *New England Economic Review*, 45-56.
- Chamon, M., & Prasad, E. (2010). Why are saving rates of urban households in China rising? *American Economic Journal: Macroeconomics*, 2(1), 93-130.
- Chaney, T., Sraer, D., & Thesmar, D. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review*, 102(6), 2381-2409.
- Chen, T., & Kung, J. K. (2016). Do land revenue windfalls create a political resource curse? Evidence from China. *Journal of Development Economics*, 123, 86-106.
- Chen T., & Kung J. K. (2018). Busting the "Princelings": The campaign against corruption in China's primary land market. *Quarterly Journal of Economics*, forthcoming.
- Chen, Z., He, Z., & Liu, C. (2017). The financing of local government in China: Stimulus loan wanes and shadow banking waxes (No. w23598). National Bureau of Economic Research.
- Chen, T., Liu, L., Xiong, W., & Zhou, L. A. (2018a). Real estate boom and misallocation of capital in China. Working paper.
- Chen, K., Wang, Q., Xu, T., & Zha, T. (2018b). Household heterogeneity and the transmission of mortgage policy in China: The speculative channel. Working paper.
- Chen, K., & Wen, Y. (2017). The great housing boom of China. *American Economic Journal: Macroeconomics*, 9(2), 73-114.
- Cheung, S. N. (2008). *The economic system of China*. Arcadia Press.

- Deng, Y., Gyourko, J., & Wu, J. (2012). Should we fear an adverse collateral effect on investment in China? Working paper.
- Deutsche Bank. (2016). Analyzing the property exposure, Market Research Report.
- Fang, H., Gu, Q., Xiong, W., & Zhou, L. A. (2016). Demystifying the Chinese housing boom. *NBER Macroeconomics Annual*, 30(1), 105-166.
- Gan, J. (2007). The real effects of asset market bubbles: Loan-and firm-level evidence of a lending channel. *Review of Financial Studies*, 20(6), 1941-1973.
- Garriga, C., Hedlund, A., Tang, Y., & Wang, P. (2017). Rural-urban migration, structural transformation, and housing markets in China (No. w23819). National Bureau of Economic Research.
- Glaeser, E., Huang, W., Ma, Y., & Shleifer, A. (2017). A real estate boom with Chinese characteristics. *Journal of Economic Perspectives*, 31(1), 93-116.
- Han, B., Han, L., & Zhu, G. (2018). Housing price and fundamentals in a transition economy: The case of the Beijing market. *International Economic Review*, 59(3), 1653-1677.
- Han, L., & Kung, J. K. (2015). Fiscal incentives and policy choices of local governments: Evidence from China. *Journal of Development Economics*, 116, 89-104.
- Kain, J. F., & Quigley, J. M. (1970). Measuring the value of housing quality. *Journal of the American Statistical Association*, 65(330), 532-548.
- Kiyotaki, N., & Moore, J. (1997). Credit cycles. *Journal of Political Economy*, 105(2), 211-248.
- Kung, J., Xu, C., & Zhou, F. (2009). From industrialization to urbanization: The social consequences of changing fiscal incentives on local governments' behavior. *Institutional Design for China's Evolving Market Economy*.
- Li, L., & Wu, X. (2014). Housing price and entrepreneurship in China. *Journal of Comparative Economics*, 42(2), 436-449.
- Liang, W., Lu, M., & Zhang, H. (2016). Housing prices raise wages: Estimating the unexpected effects of land supply regulation in China. *Journal of Housing Economics*, 33, 70-81.
- Mayer, C., Pence, K., & Sherlund, S. M. (2009). The rise in mortgage defaults. *Journal of Economic Perspectives*, 23(1), 27-50.
- Novokmet, F., Piketty, T., Yang, L., & Zucman, G. (2018). From communism to capitalism: Private versus public property and inequality in China and Russia. *AEA Papers and Proceedings*, 108, 109-13.
- Shepard, W. (2015). Ghost cities of China: The story of cities without people in the world's most populated country. London: Zed Books.
- Shi, Y. (2017). Real estate booms and endogenous productivity growth. Working paper.
- Song, Z. & Xiong, W. (2018). Risks in China's financial system. *Annual Review of Financial Economics*, forthcoming.

- Wang, S. Y. (2011). State misallocation and housing prices: Theory and evidence from China. *American Economic Review*, 101(5), 2081-2107.
- Wang, S. Y. (2012). Credit constraints, job mobility, and entrepreneurship: Evidence from a property reform in China. *Review of Economics and Statistics*, 94(2), 532-551.
- Wang, Z., & Zhang, Q. (2014). Fundamental factors in the housing markets of China. *Journal of Housing Economics*, 25, 53-61.
- Wang, Z., Zhang, Q., & Zhou, L. A. (2018). Career incentives of city leaders and urban spatial expansion in China. Working paper.
- Wei, S. J., Zhang, X., & Liu, Y. (2012). Status competition and housing prices (No. w18000). National Bureau of Economic Research.
- Wei, S. J., & Zhang, X. (2011). The competitive saving motive: Evidence from rising sex ratios and savings rates in China. *Journal of Political Economy*, 119(3), 511-564.
- Woodworth, M. D., & Wallace, J. L. (2017). Seeing ghosts: Parsing China's "ghost city" controversy. *Urban Geography*, 38(8), 1270-1281.
- Wu, J., Gyourko, J., & Deng, Y. (2015). Real estate collateral value and investment: The case of China. *Journal of Urban Economics*, 86, 43-53.
- Wu, J., Gyourko, J., & Deng, Y. (2016). Evaluating the risk of Chinese housing markets: What we know and what we need to know. *China Economic Review*, 39, 91-114.
- Yang, Z., Fan, Y., & Zhao, L. (2018). A reexamination of housing price and household consumption in China: The dual role of housing consumption and housing investment. *The Journal of Real Estate Finance and Economics*, 56(3), 472-499.
- Zhang, C., Jia, S., & Yang, R. (2016). Housing affordability and housing vacancy in China: The role of income inequality. *Journal of Housing Economics*, 33, 4-14.
- Zhang, J., Fan, J., & Mo, J. (2017). Government intervention, land market, and urban development: Evidence from Chinese cities. *Economic Inquiry*, 55(1), 115-136.
- Zhang, Y. (2017). Liquidity constraints, transition dynamics, and the Chinese housing return premium. Working Paper, Peking University.
- Zhang Z., & Xiong Y. (2018). Infrastructure financing, in Amstad, M., Sun G. and Xiong W. (Eds.), *The Handbook of China's Financial System*.
- Zhu, N. (2016). *China's Guaranteed Bubble: How Implicit Government Support Has Propelled China's Economy While Creating Systemic Risk*. New York, NY: McGraw-Hill Education.