Was China's Housing Boom a Bubble?

Carlos Garriga, Aaron Hedlund, Yang Tang, and Ping Wang

Abstract

This article investigates the factors influencing nationwide and city-level house price trends in China during the 2000s and early 2010s, considering the country's significant structural transformation and urbanization. The analysis reveals that "fundamental forces" effectively explain house price appreciation at the national level and in most cities, with Beijing and Shanghai being notable exceptions. Income growth is the primary driver of rising house prices, while population growth also plays a significant role. However, in many cases, the impact of population growth on house prices is mitigated by an accompanying increase in land supply. China's unique housing market landscape, particularly "hukou" migration restrictions, shapes house price dynamics and the responsiveness of migration to income growth, thereby amplifying the impact on house price appreciation.

JEL codes: E20, O41, R23, R31

Federal Reserve Bank of St. Louis *Review*, Fourth Quarter 2024, Vol. 106, No. 14, pp. 1-15.
https://doi.org/10.20955/r.2024.14

1. INTRODUCTION

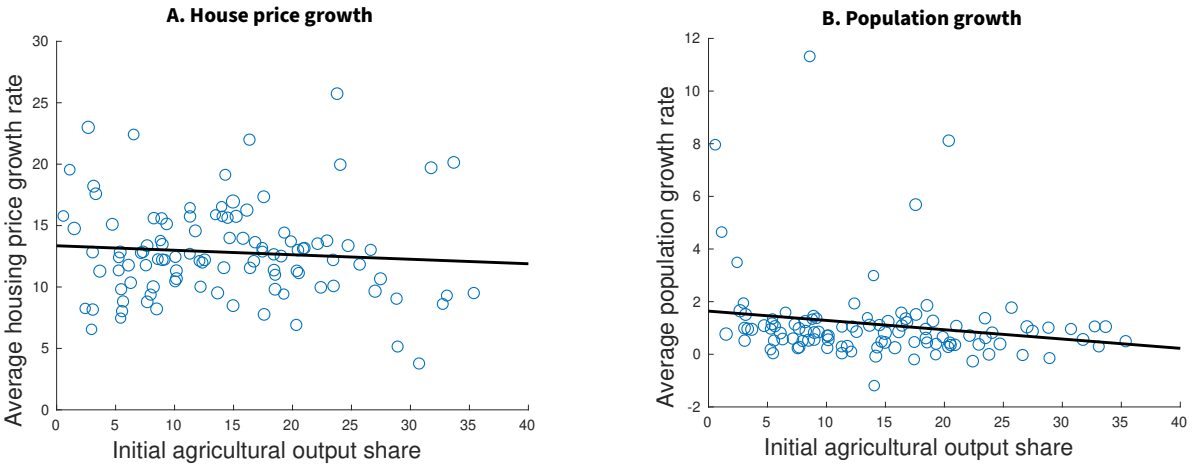
Since initiating a process of market-oriented reforms in 1978, China has grown into the world's largest provider of factory production. The country's annual economic growth rate over the past 30 years has averaged 8 percent—one of the highest rates in the world. Along with this high growth, China has undergone rapid structural transformation as economic activity shifts away from agriculture and toward manufacturing and services. Its urban centers have also witnessed large house price booms since the turn of the millennium. While significant, China's urbanization has not matched its structural transformation given that more than half of the population still lives in rural areas.

These patterns raise the natural question: Was the housing boom in China during the 2000s and early 2010s a bubble? Are fundamental economic factors insufficient to explain the rapid increase in house prices? To illustrate the relationship between China's economic transition and its house price boom, Figure 1 presents

Carlos Garriga is a senior vice president and director of research at the Federal Reserve Bank of St. Louis. Aaron Hedlund is an associate professor of economics in the Daniels School of Business at Purdue University and a research fellow at the Federal Reserve Bank of St. Louis. Yang Tang is an assistant professor in economics at Nanyang Technological University, Singapore. Ping Wang is Seigle Family Distinguished Professor in Arts and Sciences at Washington University in St. Louis and a senior research fellow at the Federal Reserve Bank of St. Louis. The authors are grateful to Jing Wu and Wei Xiong for data sharing and have benefited from fruitful discussions and valuable suggestions by Kaiji Chen, Hanming Fang, Michael Owyang, Don Schlagenhauf, Michael Zeng Song, B. Ravikumar, and an anonymous referee.

Michael Owyang and Juan Sánchez are editors in chief of the *Review*. They are supported by Research Division economists and research fellows, who provide input and referee reports on the submitted articles.

Figure 1
House Price Growth across Chinese Cities (2002–14)



the variation in house price growth from 2002 to 2014 for a sample of 105 cities, categorized by their agricultural output share at the beginning of that period.[1] The negative relationship demonstrates that house prices have grown faster in areas that had diversified away from agriculture over the preceding decades. Looking beyond the standard fundamental forces that drive house prices, structural transformation is another natural candidate for explaining house price growth in China. Intuitively, as cities modernize and diversify their industrial base, the resulting faster income growth attracts migrants from elsewhere in the country, who contribute to more rapid house price appreciation.

This article takes a two-pronged approach to answer the question of whether China's housing boom is a bubble or can be rationalized by fundamental forces. The empirical portion of the analysis conducts panel regressions to identify potential drivers of China's house price appreciation. This analysis indicates that fundamentals—specifically income and population growth from migration—rationalize the observed house price appreciation at the national level and across most cities. The notable exceptions are Beijing and Shanghai, which have experienced outsized house price gains. Among the fundamental forces, the analysis indicates that income growth is the strongest driver of rising house prices, followed by population growth. In contrast, growth in land supply acts as a dampening force on house prices. China's unique and restrictive migration policies also influence the response of migration, and therefore house prices, to income growth. The housing migration price accelerator, as explored by Garriga et al., 2021 and Garriga et al., 2023, can create a virtuous cycle of rising prices and more migration. While this can benefit urban growth and the economy, it can also exacerbate inequality.

This work connects multiple strands of active literature. One body of work studies economic development and structural transformation. Song, Storesletten, and Zilibotti (2011) provide an extensive summary of the literature on China's development since 1978, while the handbook chapter by Herrendorf, Rogerson, and Valentinyi (2014) gives an overview of the broader structural transformation literature. Another strand of literature studies migration, such as the seminal studies by Todaro (1969) and Harris and Todaro (1970), who develop a static framework where the trade-off between higher wages and unemployment risk drives migration decisions. In a dynamic setting, Lucas (2004) highlights human capital accumulation and the ongoing rise in city wages as a driver of migration. Yet another major strand of the literature is the research studying housing market behavior using the class of general equilibrium asset pricing models. Piazzesi and Schneider (2016) provide a comprehensive survey of this literature, and subsequent work further studies the role of financial frictions as drivers of housing boom-bust episodes (e.g., Garriga, Manuelli, and Peralta-Alva, 2019 and Garriga and Hedlund, 2020).

This article bridges the gap between existing research by examining the interconnected relationship between structural transformation, migration, and housing markets, both empirically and theoretically. Our asset pricing model for housing provides a framework for understanding the empirical findings. Specifically, we find

1. For house price data, we primarily use hedonic pricing models from Fang et al. (2016) up to 2014. These data are supplemented with additional information such as house types and land use from the Hang Lung Center for Real Estate at Tsinghua University (CRE), which became available starting in 2002. Both sources offer superior quality assessments compared with data from the National Bureau of Statistics. Because the CRE data only extend to 2014, our study period concludes at that point.

that housing markets respond to population shifts driven in part by wage changes due to structural transformation. However, migration also reacts to current and anticipated future house prices. The strong empirical evidence indicates that rural-urban migration is a primary catalyst for urban house price growth in China.

2. AN OVERVIEW OF CHINA'S DEVELOPMENT

This section summarizes China's development by focusing on the processes of structural transformation and urbanization as well as their impact on the housing market. The section begins by documenting some stylized facts before discussing the importance of migration policies and the deregulation of housing markets.

2.1 Structural Transformation, Urbanization, and House Prices

The Chinese economy is still in the midst of an ongoing structural transformation and urbanization. The share of employment in the agriculture sector has been declining dramatically, from almost 70 percent in 1980 to below 25 percent today. Over this same time period, the agricultural share of output has fallen from 30 percent to below 10 percent. Mirroring these trends, the share of employment in the manufacturing sector has increased from 25 percent to over 40 percent. Moreover, a significant fraction of the population has moved from rural to urban areas, with the rural population share now well below the 50 percent mark. In the period since 1980, annual migration from rural to urban areas has ranged from 0.2 percent to 3.2 percent, with a 1.5 percent average.

This process of structural transformation and urbanization would naturally have an impact on housing demand and prices. According to the National Bureau of Statistics of China, the aggregate market value of residential housing reached nearly 3.85 trillion RMB in 2009, which is 100 times than it was in 1992. In 2009, the average house price was 4,459 RMB per square meter, compared with 996 RMB per square meter in 1992.

2.2 Migration Policies

The "Third Session of the Eleventh Central Committee of the Party" in 1978 is widely believed to be the turning point in China's path of economic development. After this meeting, the country began transitioning from a centrally planned to a market-oriented economy. A key feature of the market economy is the introduction of incentive mechanisms and the reduction of the monopoly power of state-owned enterprises. The encouragement of entrepreneurship stimulated unprecedented technological progress in all sectors. As labor productivity in the agriculture sector improved, surplus rural labor became available for urban employment. However, migration across regions remained heavily regulated by the household registration system in China.

The individual/household registration system, called "hukou" in Chinese, was required by law. Each individual registration record officially identifies each person as a resident of an area and includes identifying information for each person, such as name, parents, spouse, and date of birth. In 1958, the Chinese government officially promulgated the family system to control the movement of people between urban and rural areas, categorizing individuals as either "rural" or "urban" workers. A worker seeking to move from the country to an urban area for non-agricultural work had to apply through the relevant bureaucracies, and the number of workers allowed to make such moves was tightly controlled. Migrant workers needed six passes to work in provinces other than their own, and those who worked outside their authorized domain or geographical area did not qualify for grain rations, employer-provided housing, or health care. The system imposed additional controls on education, employment, and marriage.

The hukou system is widely regarded as an impediment to economic development, and removing its restrictions is often viewed as crucial for fostering the migration needed to support industrialization. Indeed, China's reform could not have begun without changes in economic institutions. The country's rural-urban migration history can be divided into three stages based on changes in the central government migration policy that began in 1978.

1. **Early stage (1978–83):** During this early stage of reform, the key theme was slow progress. Due to the emphasis on agricultural self-sufficiency, most of the migration flows were within rural areas. Of the aggregate population flow of about 14 to 23 million during this time, only 1 million people—less than 0.1 percent of the total population—migrated across provinces. Agriculture productivity advanced during this period, but those workers who left their farmland were mainly absorbed by the local township enterprises. This shift created a phenomenon called "leave the land without leaving home." Workers left the farm labor force but still resided in rural areas.
2. **Gradual growth stage (1984–94):** As agricultural productivity continued to increase, more rural workers left the agricultural sector, and local township enterprises could not accommodate these surplus laborers. The policy of "leave the land without leaving home" was not sustainable, and as a result, policies restricting

migrants from moving from rural areas to cities were loosened to meet the needs of economic development. In 1984, the General Office of the State Council published a document on the settlement of rural migrants in urban areas, making it easier for them to migrate to the city. This reform of the household registration system drastically improved employment opportunities for rural workers, and cities grew as the mantra gradually changed to "leave both land and home." Meanwhile, instead of mainly moving to small towns, as in the early 1980s, rural workers started to move to bigger cities, including megalopolises such as Beijing and Shanghai. From 1984 to 1994, rural-urban migration generally maintained a steady pace. The average number of rural migrants moving across provinces increased to 3.2 million per year, three times as much as in the previous stage.

3. **Highly active stage (1995–2000):** Population movement in China became highly active beginning in 1995. From 1995 to 2000, the annual number of rural migrants moving across provinces grew from 3.5 to 10 million. Growth in this stage was the result of three important policy changes:
   (a) **Deng Xiaoping's southern tour:** In early 1992, Deng Xiaoping toured southern China, during which his historic speeches paved the way for significant reforms. Several special economic development zones were built, which attracted many foreign enterprises and investment. As a result, the Chinese economy boomed, with the eastern coastal area experiencing unprecedented economic growth. This growth created more jobs in cities in these zones, inducing more workers to leave rural areas.
   (b) **Replacement of central planning with markets for basic necessities:** Before 1995, the central government generally controlled the allocation of basic necessities (namely food and housing) among citizens. Workers without a legal permit to live in the city could not obtain these items, even if they could afford them, because of the absence of markets. The subsequent establishment of such markets for basic necessities greatly facilitated the entry of rural people into the city.
   (c) **Temporary work permits in large cities:** Toward the end of the 1990s, migration accelerated as a result of policies that allowed migrants to obtain temporary permits to work in large cities. In 1997, the General Office of the State Council permitted some big cities, such as Shanghai and Guangzhou, to print "blue household registration cards" or "temporary permits" for rural workers according to the city's needs. It is estimated that in Zhejiang province, one of the richest provinces in China, the rural migrant population reached 1.9 million from 1998 to 2001. Some provinces considered abolishing all official restrictions between rural and urban areas by declaring everyone a "citizen of that province" with equal treatment under the same set of policies. The salient feature of the rural-urban migration in this period was the concentration of economic development in the eastern coastal areas, which had faster economic growth and higher wages.

2.3 The Development of the Housing Market

Following the Third Session of the Eleventh Central Committee, urban housing reforms became a key focus of economic transformation. The central government adopted a cautious approach to new reforms in the public housing sector, conducting various experiments to commercialize existing urban public housing. The reform path can be divided into three subperiods, each characterized by distinct housing policies.

1. **Probation and experimentation stage (1978–88):** In April 1980, Deng Xiaoping made a speech on urban housing, noting that (i) urban residents should be allowed to purchase houses (old or new) and (ii) public housing rents should be adjusted in accordance with rising construction costs (which encouraged home buying rather than renting). These policies symbolized a major shift for the public housing system. Following Xiaoping's directive, limited experiments were conducted in selected cities between 1980 and 1998, with a focus on reorganizing housing production and promoting sales of public housing to ensure a sufficient return on housing investment. These experiments included encouraging new housing sales at the cost of building, subsidizing public housing sales, and steadily increasing public housing rents each year to promote sales.

   These policies, however, provided little incentive for private housing investment. In the centrally planned economy, housing investments were provided solely by the state through a process of redistribution. During economic reform, the central government tried to adopt policies to decentralize managerial power and introduce market functions into the economy. However, lacking experience with properly functioning markets, the majority of state-owned enterprises became less competitive than the emerging collectively owned and private enterprises. Consequently, public housing subsidized by the central government could not keep up with the increasing demand. Moreover, the private sector did not have enough incentive to move toward urban housing investment because of the risk. As a result, private investment in housing production was low and insufficient.

2. **Further urban housing reforms (1988–98)**: At the beginning of 1988, the central government held the first national housing reform conference in Beijing. They concluded that comprehensive housing reforms could lead to great economic and social benefits. The major resolutions of the conference were summarized in a document that was updated and published in 1991. This document marked a turning point in urban housing reform, from pilot tests and experiments in selected cities to implementation in all urban areas. Although there were no significant changes in the overall objectives, this was the first resolution to recognize ownership of private housing purchased from the public sector. Purchasers of public housing had two options: (i) pay the market price and have complete ownership of the unit, or (ii) pay a below-market "standard price" for partial ownership. This reform conveyed the message that the urban housing sector would eventually rely on market forces rather than on central planning.

   Although a quasi-urban housing market had been established, most participants in the market at that time were employers, not individual buyers. With different interests and more independent policies, employers and local governments purchased houses and then provided them to their employees at rents substantially below market rates. Thus, the overwhelming majority of urban residents lived in public housing that was also tied to their employment. Consequently, urban residents had less incentive to buy housing units.
3. **Current stage of urban housing reform (1998–present):** In July 1998, the new State Council adjusted the housing policy and issued an official document. One major change was the switch from directly providing housing to distributing monetary subsidies. According to the new plan, no newly built units would be allotted. The new policy symbolized the end of the existing public housing system, with the ultimate goal of fully commercializing the housing market. Nonetheless, the government continued to provide affordable housing for the lowest-income households, but the average floor space per person could not exceed 60 percent of the local average. Individuals who did not qualify for these government programs had to purchase or rent houses in the private market.

   In China, housing markets crucially depend on land supply. Even now, use rights of land are granted through leaseholds with limited duration: land is owned by the nation (officially called "the people as a whole"), and the release of new land is essentially controlled by the government. In May 2002, the Ministry of Land and Resources (MLR) ruled that all residential and commercial land parcel leasehold purchases subsequent to July 2002 were required to be sold by public auctions. That is, previously adopted private negotiations were officially banned. Since then, commonly used auctions have been of three types: English auctions (pai mai), two-stage auctions (gua pai), and sealed bids (zhao biao). To capture the initial change from negotiated to auctioned prices, we set our sample period to start in 2001. By August 31, 2004, all urban land leasehold sales were through public auctions with Internet posting to the public. Nonetheless, local land bureaus remained in charge of the annual allocation of land plots for development, the associated regulations including the floor area ratios, and the types and reservation prices for auctions.

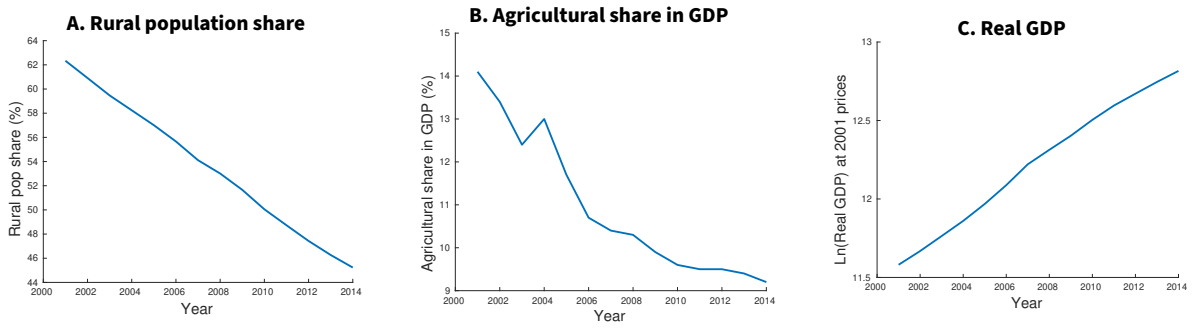
   Clearly, the ability to purchase houses also depends on functioning credit markets. In China, mortgage rates and down payment requirements are controlled by the government. For example, cities planning for faster growth set lower mortgage rates. By contrast, stricter down payment requirements have been used to cool down housing markets experiencing rapid price appreciation. In April 2010, many cities with rapidly rising house prices implemented the Home Purchase Restriction policy that imposed limits on multiple home purchases for residents and on all home purchases for non-residents.

3. STYLIZED FACTS

This section establishes key stylized facts related to the drivers of house price and migration dynamics for the period 2001 to 2014. Data on house prices, land sales, and population covering 105 cities come from the CRE. As determinants of housing demand, data on city-level employment, output shares, and per capita income come from the City Statistical Yearbook of China, and the National Statistical Yearbook provides additional city-level aggregates. Migration responds to many of these same variables but is constrained by residential permits as described in the previous section. Thus, the data also include a hukou index that measures the permissiveness of hukou restrictions, with smaller values representing less permissive (i.e., stricter) controls. These data are extended from Fan (2019) using the Peking University Law Information Database.[2] As in Fan (2019), the procedure to construct the hukou index involves collecting the laws and regulations implemented at the prefecture level that are potentially related to hukou reform, by searching for a set of keywords including any combination of "hukou" or "huji" (which also means hukou) with "gaige" (reform) or "guanli" (management), together with "chengshihua" or "chengzhenhua" (both mean urbanization) and "luohu" or "ruhu" (both mean

2. See http://www.lawinfochina.com/.

Figure 2
Structural Transformation and Economic Growth in China



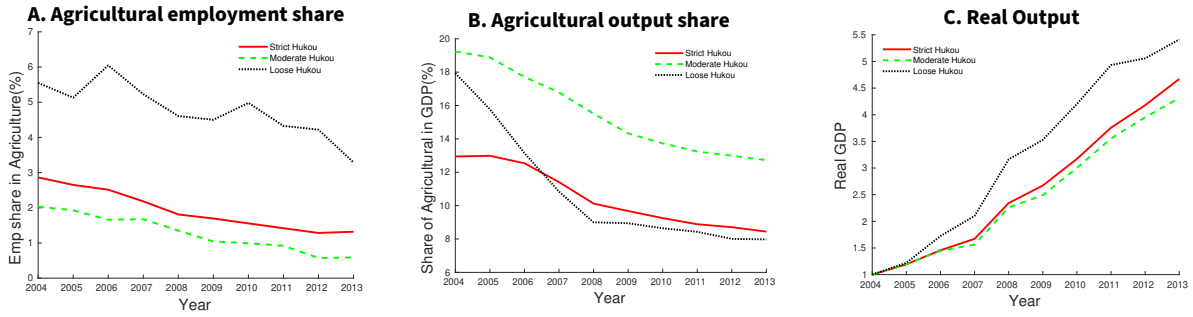
NOTE: Panel A shows the rural population share in percentage points, while Panel B shows the agricultural output share in GDP in percentage points. Panel C presents the log level of real GDP using 2001 prices.

granting hukou). The procedure then applies the same scoring system as in Fan (2019) by only considering the central districts and criteria (depending on housing tenure status and the length of contributions to local social security) to the prefectures in the sample.

Nationwide, China has undergone a rapid process of urbanization, structural transformation away from agriculture, and economic growth, as shown in Figure 2. The country's rural population share dropped from 62.3 percent in 2002 to 45.2 percent by 2014 at the same time that its agricultural output share fell from 14 to 9.2 percent. Meanwhile, China's real GDP (plotted in natural logs) rose sharply by more than threefold.

These national trends also manifest themselves in the cross-section of cities grouped by their hukou index. As shown in Figure 3, the agriculture employment and GDP shares decline over time for each of the groups of cities. However, there is substantial variation in levels across the city groupings.

Figure 3
Cross-Sectional Trends in Structural Transformation by Hukou Index

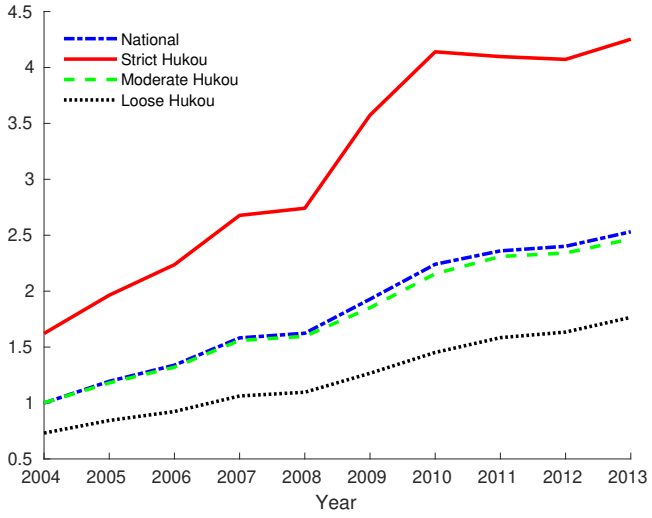


NOTE: Panel A presents the employment share in the agricultural sector in percentage points, while Panel B presents the agricultural output share in GDP in percentage points. Panel C shows the log level of real GDP using 2001 prices. We present results for three city groups according to the permissiveness of hukou regulation. We first obtain the results at the city level and then aggregate them into each group using population as the weight.

Cities with a hukou index of 3 (the most permissive, i.e., loosest, restrictions) consistently exhibit the highest agricultural employment share, but their agricultural GDP share falls the most precipitously. By contrast, cities with a moderate hukou index of 2 have the lowest agricultural employment share but the highest such GDP share, indicating they are very productive in agriculture. Nevertheless, their agricultural GDP share is no exception to the pattern of substantial decline experienced by the other cities. The rapid drop-off in agricultural employment and GDP shares is mirrored by a dramatic and broad-based rise in real GDP as workers shift into higher-productivity sectors, with hukou-3 cities showing the starkest increase.

The aforementioned boom in economic growth is apparent in the housing market as well, where national house prices more than doubled over the span of just a decade of nearly 9 percent annual appreciation. For the 105 cities and sample period analyzed in this article, annual appreciation rates are 14.9 percent for hukou-1 cities, 13.5 percent for hukou-2 cities, and 12.2 percent for hukou-3 cities, with five cities (including Beijing) exhibiting annual appreciation in excess of 20 percent per year and only one city (Heyuan) showing price

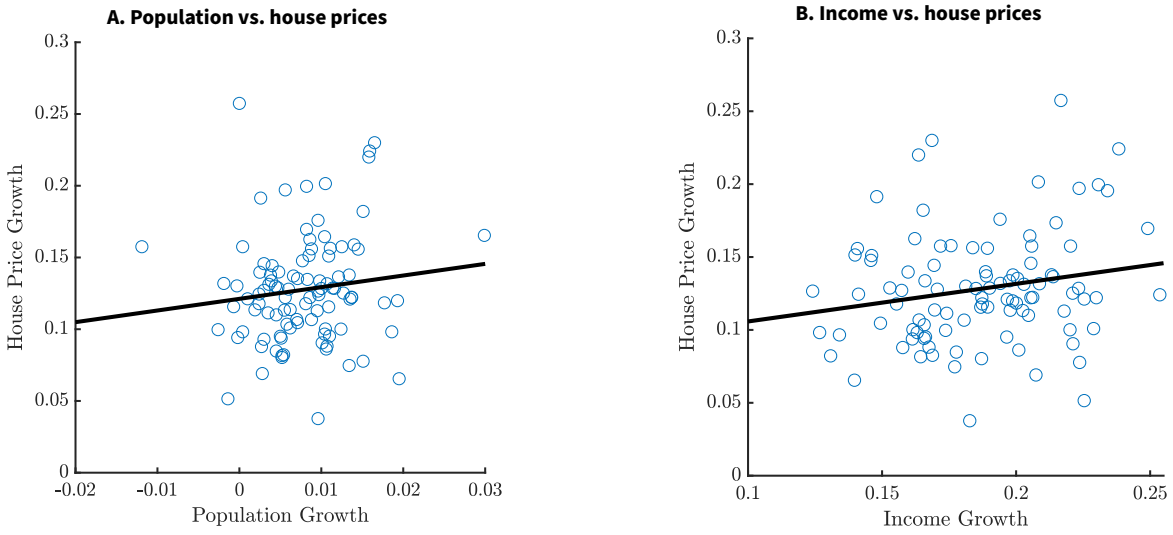
Figure 4
Cross-Sectional Trends in House Prices by Hukou Index



Notes: We plot the evolution of house prices per square meter from 2004 to 2013 at the national level and at each city group based on hukou permissiveness. We normalize the national house price level in 2004 to be 1.

growth under 5 percent. Thus, the data shown in Figure 4 indicate that more stringent hukou policies are associated with faster house price gains.[3] One might expect the opposite relationship, with stricter migration policies dampening house price growth by limiting the population inflows that serve as an important source of housing demand. Indeed, this channel from migration policies to house prices may explain the relationship observed in the data once one accounts for the fact that such migration policies are not randomly assigned to cities—they are chosen by Chinese authorities who have shown an interest at times in attempting to cool price growth. Thus, it may be more appropriate to say that faster house price growth is associated with more stringent hukou policies.

Figure 5
Population and Income Growth as Drivers of House Price Appreciation

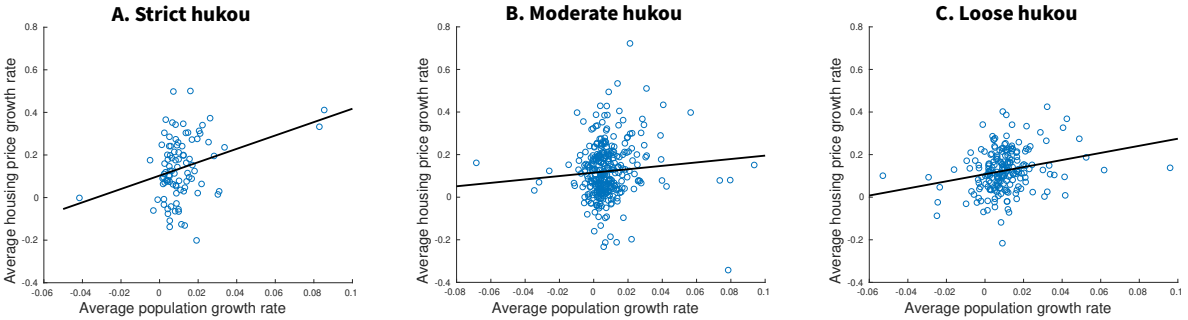


NOTE: Each dot represents a city. Outliers (those with annual population growth above 0.03 or income growth above 0.25) have been excluded.

3. For reference, when one considers the four largest megacities in China, Beijing has a hukou index of 1, while Shanghai, Guangzhou, and Shenshen have an index of 2. Thus, hukou permissiveness depends on characteristics other than just population size.

The first panel in Figure 5 is consistent with the previous logic about population increases acting as a positive driver of house price growth. Similarly, the second panel reveals a positive link from income to house prices at the city level. These unconditional correlations remain even after dividing the sample period into two- to four-year intervals.

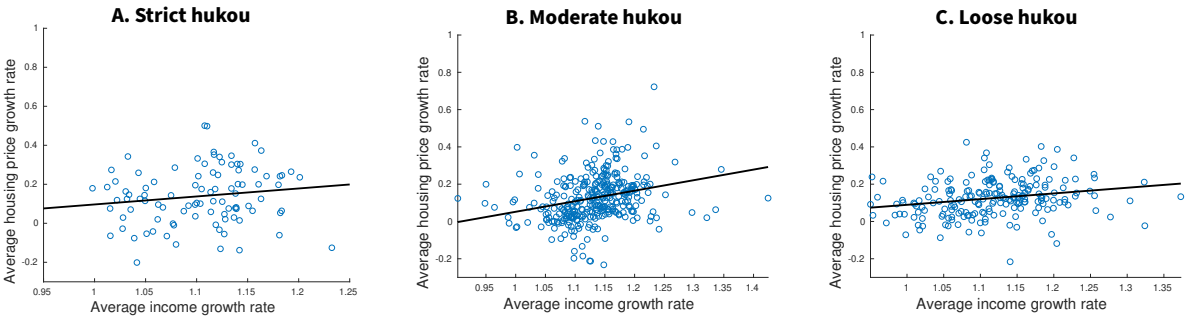
Figure 6
Population and House Price Growth by Hukou Index



NOTE: This figure repeats the exercise in Panel A of Figure 5 by city group based on the permissiveness of hukou regulation. Each dot represents a city.

Investigating these correlations by hukou index reveals the same general pattern. Figure 6 depicts a noticeably stronger relationship between house price growth and population growth in hukou-3 cities than in hukou-2 cities, yet house prices are the most responsive to population growth in hukou-1 cities with the least permissive migration policies—likely due to the endogeneity of migration policies, as previously discussed. In particular, Beijing has some of the tightest hukou controls, in no small part as an effort by authorities to contain runaway house price growth. By contrast, the relationship between income growth and house price growth is more broadly similar across the groupings of city by hukou index, as shown in Figure 7.

Figure 7
Income and House Price Growth by Hukou Index



NOTE: This figure repeats the exercise in Panel B of Figure 5 by city group based on the permissiveness of hukou regulation. Each dot represents a city.

4. AN ILLUSTRATIVE MODEL OF HOUSE PRICES

The previous scatter plots reveal compelling links between population movements, income growth, and house price appreciation. This section constructs an illustrative housing model that connects income and population growth with house price dynamics to interpret the empirical findings.

4.1 Theoretical Results

Consider an urban economy with a continuum of identical households whose population N_t follows the law of motion $N_{t+1} = (1 + g_N)N_t$, where g_N is the population growth rate. Each household supplies one unit of labor each period and earns a market wage of w_t. Households have preferences over a composite good c_t and housing h_t given by the utility function $u(c_t, h_t)$, and they value future utility using the discount factor $\beta < 1$. The price of housing in period t is p_t, and there are no transactions costs to trading housing. Households can borrow and save at interest rate r_{t+1}.

The household's lifetime utility maximization problem is given by

$$\max_{c_t,h_t,b_{t+1}} \sum_{t=0}^{\infty} \beta^t u(c_t,h_t) \quad \text{subject to} \quad c_t + p_t h_t + b_{t+1} = w_t + p_t h_{t-1} + (1+r_t)b_t. \tag{1}$$

The optimality condition for dynamic consumption and saving behavior is

$$u_c(c_t,h_t) = \beta(1+r_{t+1})u_c(c_{t+1},h_{t+1}). \tag{2}$$

Intuitively, by increasing savings by one unit today, consumption declines by one unit, reducing utility by the marginal utility of consumption, $u_{c,t} \equiv u_c(c_t,h_t)$. However, consumption is then $1+r_{t+1}$ units higher in the following period, which increases utility by $(1+r_{t+1})u_{c,t+1}$, which the household views as $\beta(1+r_{t+1})u_{c,t+1}$ in present-day utility units due to the discount factor. The same logic operates in reverse for a decline in savings (implying higher consumption today and less consumption in the future). Either way, optimality says that the marginal benefit of making a change exactly equals the marginal cost.

The optimality condition for housing is

$$p_t = \frac{u_h(c_t,h_t)}{u_c(c_t,h_t)} + \beta \frac{u_c(c_{t+1},h_{t+1})}{u_c(c_t,h_t)} p_{t+1}. \tag{3}$$

In words, purchasing a house at price p_t costs the household p_t units of consumption today but delivers one unit of housing services—valued by the household at $u_{h,t}/u_{c,t}$ units of present-day consumption—plus the value of selling the house in the future. If the future resale price is p_{t+1}, then future consumption increases by $u_{c,t+1}$, which in present-day utility units is $\beta u_{c,t+1}$. Dividing by $u_{c,t}$ then converts from present-day utility units to consumption units. As before, the same logic operates for a reduction in housing. The optimality condition says that the household adjusts their consumption of housing until the marginal benefit equals the marginal cost.

Defining $R_t = \frac{u_h(c_t,h_t)}{u_c(c_t,h_t)}$ as implicit rents and combining the above optimality conditions gives the following expression for house prices:

$$p_t = R_t + \frac{p_{t+1}}{1+r_{t+1}}. \tag{4}$$

The equation above essentially states the no-arbitrage condition between buying a house today and renting today and buying tomorrow. Iterating forward yields the expression

$$p_t = \sum_{\tau=0}^{\infty} \frac{R_{t+\tau}}{\Pi_{\tau'=1}^{\tau}(1+r_{t+\tau'})}, \tag{5}$$

which states that a house's value is equal to the discounted flow value of future implicit rents.

To accommodate the growing population, the government makes $g_H H_t$ units of housing available to the public each period, where H_t is the total housing stock. Thus, the law of motion is $H_{t+1} = (1+g_H)H_t$. For the composite consumption good, let the production technology be linear in labor, $y_t = A_t N_t$, with productivity growing exogenously at rate g_A. Thus, productivity follows the law of motion $A_{t+1} = (1+g_A)A_t$. Under competitive labor markets, all workers are paid the marginal product of labor, which implies $w_t = A_t$.

One can obtain an analytical solution for house prices, rents, and interest rates using the log-linear utility function $u(c_t,h_t) = \theta \log(c_t) + (1-\theta)\log(h_t)$. To solve for house prices, let $\gamma \equiv (1-\theta)/\theta$ for notational convenience, and iterate forward on equation 3 as follows:

$$\begin{aligned}
p_t &= \gamma \frac{c_t}{h_t} + \beta \frac{c_t}{c_{t+1}} \left(\gamma \frac{c_{t+1}}{h_{t+1}} + \beta \frac{c_{t+1}}{c_{t+2}} p_{t+2} \right) \\
\Rightarrow p_t &= \gamma \frac{c_t}{h_t} + \gamma\beta \frac{c_t}{h_{t+1}} + \beta^2 \frac{c_t}{c_{t+2}} \underbrace{\left(\gamma \frac{c_{t+2}}{h_{t+2}} + \beta \frac{c_{t+2}}{c_{t+3}} p_{t+3} \right)}_{p_{t+2}} \\
\Rightarrow p_t &= \gamma \frac{c_t}{h_t} + \gamma\beta \frac{c_t}{h_{t+1}} + \gamma\beta^2 \frac{c_t}{h_{t+2}} + \gamma\beta^3 \frac{c_t}{c_{t+3}} p_{t+3}.
\end{aligned}$$

Continuing this pattern and substituting the market clearing conditions $c_t = A_t N_t$ and $h_t = H_t$ and the law of motion for housing supply, $H_{t+\tau} = (1 + g_H)^\tau H_t$ gives

$$p_t = \gamma \frac{A_t N_t}{H_t} + \gamma\beta \frac{A_t N_t}{(1+g_H)H_t} + \gamma\beta^2 \frac{A_t N_t}{(1+g_H)^2 H_t} + \gamma\beta^3 \frac{A_T N_t}{(1+g_H)^3 H_t} + \dots$$

which can be written as

$$p_t = \gamma \frac{A_t N_t}{H_t} \sum_{\tau=0}^{\infty} \left(\frac{\beta}{1+g_H} \right)^\tau .$$

Replacing $\gamma = (1-\theta)/\theta$ and using the geometric series formula gives the final answer of

$$p_t = \left(\frac{1-\theta}{\theta} \right) \left(\frac{1}{1 - \frac{\beta}{1+g_H}} \right) \frac{A_t N_t}{H_t}. \tag{6}$$

This expression states that the level of house prices is proportional to productivity and total available labor and is inversely proportional to the size of the housing stock in a way that depends on the strength of preference for housing relative to consumption. The number of housing units in the denominator, H_t, highlights the importance of housing supply.

The expression also illuminates the factors driving house price variation over time by dividing p_{t+1} by p_t, which gives

$$\frac{p_{t+1}}{p_t} = \frac{A_{t+1} N_{t+1} / H_{t+1}}{A_t N_t / H_t} = \frac{\frac{A_{t+1}}{A_t} \frac{N_{t+1}}{N_t}}{\frac{H_{t+1}}{H_t}}. \tag{7}$$

There are three channels that affect house price growth: (i) labor productivity in urban areas, (ii) population growth, and (iii) the supply of new housing. Algebraically, house price appreciation follows $1 + g_p \equiv p_{t+1}/p_t = (1+g_A)(1+g_N)/(1+g_H)$. Taking logs and defining $\widetilde{g} \equiv \ln(1+g)$ for each of the growth rates gives rise to the following linear relationship:

$$\widetilde{g}_p = \widetilde{g}_A + \widetilde{g}_N - \widetilde{g}_H. \tag{8}$$

Now suppose that housing is produced according to a decreasing returns to scale function of land given by $H_{t+1} = B_t L_t^\alpha$, where B_t can reflect various factors including construction productivity. In this case, the growth of housing supply is given by $\widetilde{g}_H = \widetilde{g}_B + \alpha \widetilde{g}_L$, where $\widetilde{g}_B$ can be interpreted as productivity growth and $\widetilde{g}_L$ is the growth rate in newly available land. Given low observed construction productivity growth, let $\widetilde{g}_B = 0$. Then the expression for house price growth is

$$\widetilde{g}_p = \widetilde{g}_A + \widetilde{g}_N - \alpha \widetilde{g}_L. \tag{9}$$

Dividing both sides by $\widetilde{g}_p$ gives the following decomposition for house price growth:

$$1 = \frac{\widetilde{g}_A}{\widetilde{g}_p} + \frac{\widetilde{g}_N}{\widetilde{g}_p} - \alpha \frac{\widetilde{g}_L}{\widetilde{g}_p}. \tag{10}$$

From a theoretical perspective, this expression quantifies the contribution of each individual factor to the total variation of house prices, normalized to 1.

4.2 Quantitative Results

In reality, there are other factors in the data not captured by the basic model—such as endogenous migration, the role of hukou restrictions, differences across cities in construction technology, and labor market distortions—that may prevent the empirical measures on the right-hand side of equation 10 from summing to one. Let this residual be "Others." Thus, the quantitative contribution of each factor to house price changes is given by

$$1 = \frac{\widetilde{g}_A}{\widetilde{g}_p} + \frac{\widetilde{g}_N}{\widetilde{g}_p} - \alpha \frac{\widetilde{g}_L}{\widetilde{g}_p} + \frac{\widetilde{g}_{\text{Others}}}{\widetilde{g}_p}. \tag{11}$$

Table 1
Growth Rates of House Prices and Driving Factors

	House price(%)	Population(%)	Productivity(%)	Land supply(%)
National	8.88	3.47	6.81	3.95
Strict hukou	13.36	1.27	10.90	9.00
Moderate hukou	12.79	0.99	13.27	11.68
Loose hukou	12.48	1.30	11.61	23.07
Beijing	14.09	1.57	13.56	7.06
Shanghai	9.90	0.90	15.69	18.64
Guangzhou	10.75	1.09	9.29	29.55
Shenzhen	5.49	0.60	12.74	16.37

NOTE: This table reports the contribution of population, productivity, and land supply to house price growth and for different groupings of cities.

The decomposition proceeds first at the national level, then by the permissiveness of hukou restrictions for a subset of 105 cities and, finally, for the four megacities of Beijing, Shanghai, Guangzhou, and Shenzhen. To reiterate, the national data are not an aggregate of the data for each of the hukou index values, as the latter is for a sample of cities, not the universe. Following Garriga et al. (2023), the decomposition uses a value of $\alpha = 0.27$ for regular houses and $\alpha = 0.18$ for apartments.

Table 1 provides the raw growth rates for house prices and each of the driving factors listed in the decomposition from equation 11. Comparing the national data to that for the hukou groupings, one striking observation is that house price growth is noticeably faster among all of the hukou groupings corresponding to the subset of 105 cities. Considering that these cities all have slower population growth and faster land supply expansion than the nation as a whole—which should imply *slower* house price growth for the hukou groupings—productivity emerges as the critical factor. Whereas productivity growth is 6.81 percent at the national level, it is over 10 percent for each of the hukou groupings. The high productivity growth among the four megacities is also a driving force behind their rapid house price appreciation—though Shenzhen stands out as an exception, with both low house price growth and much slower population growth.

Table 2
House Price Decomposition for Regular Houses ($\alpha = 0.27$)

	Population	Productivity	Land supply	Others
National	39.1%	76.7%	–12.0%	–3.8%
Hukou index 1	9.5%	81.6%	–18.2%	27.1%
Hukou index 2	7.7%	103.8%	–24.7%	13.2%
Hukou index 3	10.4%	93.0%	–49.9%	46.5%
Beijing	11.1%	96.3%	–13.5%	6.1%
Shanghai	9.1%	158.5%	–50.8%	–16.8%
Guangzhou	10.1%	86.4%	–74.2%	77.7%
Shenzhen	10.9%	231.9%	–80.4%	–62.3%

NOTE: This table repeats exercises in Table 1 only for regular houses, in which land share, α, equals 0.27.

Tables 2 and 3 quantify the contribution of productivity along with the other factors for the two values of α. At the national level, productivity growth explains over three-quarters of house price appreciation, followed by population growth at 39.1 percent. In Table 2, expansion in land supply *reduces* house price growth, contributing –12 percent. The net effect of the other factors is minimal at only –3.8 percent. Among the hukou groupings using the sample of 105 cities, productivity has an even larger contribution, with land supply taking on a larger (more negative) role and population growth not as significant of a factor. In this case, "Others" is more important than it is for the national data. The first two columns of Table 3 are identical to those in Table 2, but the contribution of land supply is smaller (less negative) across the board.

Table 3
House Price Decomposition for Apartments ($\alpha = 0.18$)

	Population	Productivity	Land supply	Others
National	39.1%	76.7%	–8.0%	–7.8%
Hukou index 1	9.5%	81.6%	–12.1%	21.0%
Hukou index 2	7.7%	103.8%	–16.4%	4.9%
Hukou index 3	10.4%	93.0%	–33.3%	29.8%
Beijing	11.1%	96.3%	–9.0%	1.6%
Shanghai	9.1%	158.5%	–33.9%	–33.7%
Guangzhou	10.1%	86.4%	–49.5%	52.9%
Shenzhen	10.9%	231.9%	–53.6%	–89.2%

NOTE: This table repeats exercises in Table 1 only for apartments, in which land share, α, equals 0.18.

5. REGRESSION ANALYSIS

The illustrative model provides an intuition for the patterns revealed in the stylized facts—namely that faster population growth leads to more rapid house price appreciation, while more robust increases in land supply slow house price growth. However, it does not explicitly include a channel for migration or hukou permitting policies. This section examines the empirical link between population movements, income growth, and house price changes in a more flexible manner using panel data from China. Special attention is also paid to the permissiveness of hukou permits.

Table 4
Income Growth and House Price Growth by Hukou Regulation Permissiveness

	Strict hukou	Moderate hukou	Loose hukou
2-4 Income growth	-0.01	0.39***	0.49***
	(0.17)	(0.10)	(0.11)
N	126	329	192
R-squared	0.000	0.047	0.063

NOTE: We run a panel regression between income growth and house price growth at each city group based upon the permissiveness of hukou regulation. Both city and year fixed effects are controlled. *p<0.10, ** p<0.05, *** p<0.01.

For the first two sets of regressions, we segment the sample by hukou index and examine how house prices respond to income and population growth. The results in Table 4 suggest that while the impact of income growth on house price growth is weak with tight hukou controls (hukou index of 1), there is a strong relationship with more permissive hukou controls (index of 2 or 3). One possible explanation is that the migration response to rising income is stronger in cities with looser hukou restrictions, thus putting greater pressure on housing demand. In Table 5, house price growth increases with population growth across all the subsamples. However, the response is stronger in areas with strict hukou controls, likely due to policy endogeneity. In other words, the government is likely to impose tighter hukou controls in places where house prices are more sensitive to population growth in an attempt to limit house price growth. Viewed together, the results in these regressions indicate that both income and population growth lead to rising house prices.

The next set of regressions pools the samples but adds controls for the hukou permissiveness, allow for interactive terms between the hukou index and either income or population growth, and include city fixed effects. Table 6 shows the set of results relating income growth to house price growth. Column 1 confirms that faster income growth is associated with more rapid house price appreciation. However, columns 3 and 4 show that this link is entirely absorbed into the interactive term between income growth and the hukou index. This finding provides suggestive evidence that anything that facilitates greater migration—whether it be faster incomes encouraging people to move to the city or looser hukou policies permitting more population flows—pave the way for higher house price growth. The modest, independent negative effect of a higher hukou index (i.e., looser restrictions) on house prices likely suggests reverse causation: cities with slower house price growth may be less inclined to impose stricter migration controls.

In Table 7, faster population growth is associated with greater house price appreciation, just as before.

Table 5
Population Growth and House Price Growth by Hukou Permissiveness for 105 Cities

	Strict hukou	Moderate hukou	Loose hukou
2-4 Population growth	0.42***	0.16***	0.19***
	(0.10)	(0.03)	(0.05)
N	126	329	192
R-squared	0.096	0.075	0.041

NOTE: We run a panel regression between population growth and house price growth for cities grouped by their hukou permissiveness. Both city and year fixed effects are controlled. *p<0.10, ** p<0.05, *** p<0.01.

Table 6
Income Growth and House Price Growth: 105 Cities

	(1)	(2)	(3)	(4)
2-5 Income growth	0.39***	0.53***	-0.08	-0.03
	(0.07)	(0.10)	(0.24)	(0.30)
Hukou index	-0.02**	-0.02	-0.04***	-0.05**
	(0.01)	(0.01)	(0.01)	(0.02)
Income growth × hukou index			0.22**	0.26**
			(0.10)	(0.13)
N	630	630	630	630
R-squared	0.055	0.139	0.062	0.146
City FE	No	Yes	No	Yes

NOTE: We run a panel regression between income growth and house price growth by controlling city group and including an interaction term between city group and income growth rate. *p<0.10, ** p<0.05, *** p<0.01.

Likewise, the negative coefficient on the hukou index likely reflects reverse causality: the faster house prices rise, the more cities will feel compelled to tighten hukou restrictions (implying a lower hukou index). In this set of regressions, the interaction term between population growth and the hukou index is not statistically significant.

Table 7
Population Growth and House Price Growth: 105 Cities

	(1)	(2)	(3)	(4)
2-5 Population growth	0.19***	0.20***	0.33***	0.33**
	(0.03)	(0.03)	(0.10)	(0.14)
Hukou index	-0.02***	-0.03**	-0.02**	-0.03**
	(0.01)	(0.01)	(0.01)	(0.01)
Population growth × hukou index			-0.06	-0.06
			(0.04)	(0.06)
N	630	630	630	630
R-squared	0.080	0.157	0.082	0.158
City FE	No	Yes	No	Yes

NOTE: We run a panel regression between population growth and house price growth by controlling city group and including an interaction term between city group and population growth rate. *p<0.10, ** p<0.05, *** p<0.01.

Taken together, the various sets of regressions confirm and enhance the insights provided by the model and scatter plots. Specifically, house price growth exhibits a positive correlation with income growth, particularly in regions with more relaxed hukou restrictions that do not impede the endogenous response of migration,

which, in turn, further fuels house prices by increasing population growth.

The housing migration price accelerator, as explored by Garriga et al., 2021 and Garriga et al., 2023, posits a virtuous cycle where increased migration to a region drives up house prices, which in turn attracts more migrants, further fueling price appreciation. This phenomenon can significantly contribute to urban growth, economic development, and income inequality. As housing prices rise, the region becomes more attractive to individuals seeking economic opportunities and a higher quality of life, leading to a self-reinforcing feedback loop. However, this rapid appreciation can also exacerbate affordability issues and contribute to urban sprawl. Understanding the housing migration price accelerator is crucial for policymakers seeking to balance economic growth with social equity and sustainable urban development.

6. CONCLUSION

The analysis in this article provides suggestive evidence that fundamental factors related to structural transformation and migration—in particular, income and population growth—can largely explain house price appreciation in China, albeit with substantial heterogeneity across cities. Moreover, the inability of these forces to explain *all* of the city-by-city house price appreciation on their own is not evidence by itself of a bubble. Instead, it is important to note that the model framework presented here abstracts from potentially important interactions between trends in productivity, migration, financial market innovation, and the shifting urban landscape. Nevertheless, other work does speak to the issue of bubbles, such as Himmelberg, Mayer, and Sinai (2005), Wu, Gyourko, and Deng (2016), and Chen and Wen (2017). In addition, Garriga et al. (2023) take a contrary stance, arguing that bubble-like house price appreciation is actually largely a result of economic fundamentals.

What are the important implications for policy derived from this research? One is that China's house prices do not seem to be at odds with market fundamentals, contrary to the beliefs of many economic commentators. The analysis here certainly does not rule out the possibility of bubbly forces at play, but they are not strictly necessary to rationalize the behavior of Chinese housing markets. If anything, the analysis in this article suggests that nonfundamental drivers may emerge in cities with tighter hukou controls that distort economic fundamentals, such as in Beijing and Shanghai. Further research should examine the potential of hukou reforms to alleviate distortions to housing markets and their resulting impact on migration.

REFERENCES

Chen, Kaiji, and Yi Wen. 2017. The Great Housing Boom of China. *American Economic Journal: Macroeconomics* 9, no. 2 (April): 73–114. https://ideas.repec.org/a/aea/aejmac/v9y2017i2p73-114.html.

Fan, Jingting. 2019. Internal geography, labor mobility, and the distributional impacts of trade. *American Economic Journal: Macroeconomics* 11 (3): 252–88.

Fang, Hanming, Quanlin Gu, Wei Xiong, and Li-An Zhou. 2016. Demystifying the chinese housing boom. *NBER Macroeconomics Annual 2015* 30:105–166.

Garriga, Carlos, and Aaron Hedlund. 2020. Mortgage Debt, Consumption, and Illiquid Housing Markets in the Great Recession. *American Economic Review* 110 (6): 1603–34.

Garriga, Carlos, Aaron Hedlund, Yang Tang, and Ping Wang. 2021. Rural-Urban Migration and House Prices in China. *Regional Science and Urban Economics* 91.

———. 2023. Rural-Urban Migration, Structural Transformation, and Housing Markets in China. *American Economic Journal: Macroeconomics* 15 (2): 413–40.

Garriga, Carlos, Rodolfo Manuelli, and Adrian Peralta-Alva. 2019. A Macroeconomic Model of Price Swings in the Housing Market. *American Economic Review* 109, no. 6 (June): 2036–2072. https://ideas.repec.org/a/aea/aecrev/v109y2019i6p2036-72.html.

Harris, John R., and Michael P. Todaro. 1970. Migration, unemployment and development: a two-sector analysis. *The American Economic Review* 60 (1): 126–142. ISSN: 00028282. http://www.jstor.org/stable/1807860.

Herrendorf, Berthold, Richard Rogerson, and Ákos Valentinyi. 2014. Growth and Structural Transformation. Chap. 6 in *Handbook of Economic Growth,* 2:855–941. Elsevier. https://doi.org/10.1016/B978-0-444-53540-. https://ideas.repec.org/h/eee/grochp/2-855.html.

Himmelberg, Charles, Christopher Mayer, and Todd Sinai. 2005. *Assessing high house prices: bubbles, fundamentals, and misperceptions.* Working Paper, Working Paper Series 11643. National Bureau of Economic Research, September. https://doi.org/10.3386/w11643. http://www.nber.org/papers/w11643.

Lucas, Robert E. 2004. Life Earnings and Rural-Urban Migration. *Journal of Political Economy* 112, no. S1 (February): 29–59. https://ideas.repec.org/a/ucp/jpolec/v112y2004is1ps29-s59.html.

Piazzesi, Monika, and Martin Schneider. 2016. Housing and Macroeconomics. *Handbook of Macroeconomics, Volume 2,* 1547–1640.

Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti. 2011. Growing Like China. *American Economic Review* 101, no. 1 (February): 196–233. https://ideas.repec.org/a/aea/aecrev/v101y2011i1p196-233.html.

Todaro, Michael P. 1969. A model of labor migration and urban unemployment in less developed countries. *The American Economic Review* 59 (1): 138–148. ISSN: 00028282. http://www.jstor.org/stable/1811100.

Wu, Jing, Joseph Gyourko, and Yongheng Deng. 2016. Evaluating the risk of Chinese housing markets: What we know and what we need to know. *China Economic Review* 39 (C): 91–114. https://doi.org/10.1016/j.chieco.2016.03.. https://ideas.repec.org/a/eee/chieco/v39y2016icp91-114.html.