Real estate prices, fiscal revenue and economic growth

Xiaoyu Gao[1], **Anjie Dong**[2]

Abstract

This paper attempts to analyze the relationship between government land prices and fiscal revenues, economic growth, to test the short-term and long-term effects of rising real estate prices on fiscal revenue and GDP growth. This paper attempts to explain two problems with empirical data: (1) Whether it is for the government, pushing up house prices can not escort economic growth, and the long-term utility of the government is conserved; (2) and pushing up house prices at the quantitative level, for the economy and How much quantitative impact fiscal revenue has on the short-term and long-term, respectively. In the end, it is concluded that pushing up house prices does not promote government effectiveness. For the government, it is ultimately tax-equivalent.

Keywords：Real estate price; land finance; economic growth;

1. Introduction

There is no such price increase as the increase in property price can arouse the attention of the whole society. Since 2001, the real estate price of China has risen the most among the G20 countries, and also the engaged population is the most numerous. Knoll et al. (2017) found that the rise in the house price is a phenomenon that almost all countries in the world will encounter during the stage of rapid economic growth. However, from the relationship between the average household income and real estate prices, there is hardly any country that had its property price growing under such an astonishing rate and magnitude as China since the 19th century.

The inflation in real estate prices has become one of the most significant difficulties in people's lives and also a potential threat to the active growth of the economy. To solve the problem of expensive home prices is a vital issue. However, many discussions about what makes the home price costly were raised, with some viewpoints against each other. The focus of this paper is to try to study the relationship among the property price, economic growth, and fiscal revenue.

For the most widely used 100-city Price Index, the 100 cities' average property price was 9,042 RMB in June 2010. By December 2016, the average rate had increased by 45% to 13,035 RMB. The tier-one cities (Beijing, Shanghai, Guangzhou, and Shenzhen) saw a more substantial price jump. In June 2010, the average price was 20,780 RMB; and in December 2016, it soared 94% to 40,450 RMB. During the same

[1] PBC School of Finance, Tsinghua University, 43 Chengfu Road, Beijing 100083, China
[2] New York University, 70 Washington Square South, New York, NY, 10012

period, it is hard to observe such a surge in other assets' returns. Moreover, due to statistical bias and policy reasons, these figures underestimate the real cost and its leap. Taking Beijing as an example, the 100-city residential price index shows that the sample residential price of Beijing at the end of 2016 was 41,000 RMB. In fact, according to the transaction data displayed by various property agencies, the average home price in Beijing is no less than 55,000 RMB. Considering the low density of suburban counties, the real cost of Beijing urban area should be significantly higher than 55,000 RMB. Even from the 100-city Price Index, the increase in real estate prices is considered rapid.

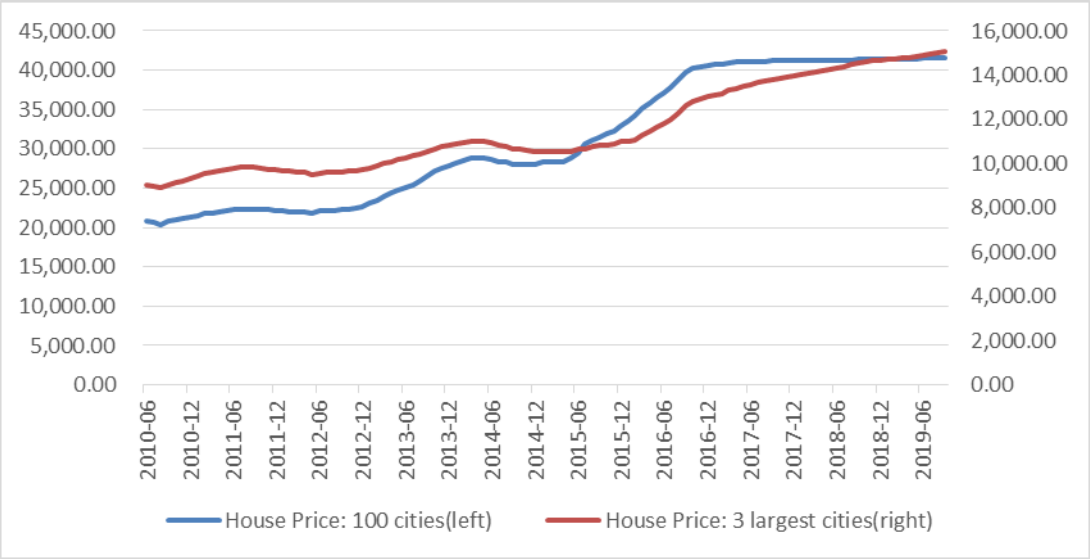


Figure 1. Historical trends of the 100-city Price Index and the property price in the first-tier cities

Compared to other countries across the globe, China's real estate price has reached a relatively high level. Of course, it is insignificant to examine absolute prices, because the stage of development differs across countries, and the residential income level and its growth rate also vary significantly. Therefore, when comparing across countries, people often use the ratio of home price-to-income.

The following table compares the price-to-income ratio of first-tier cities in China and the United States and concludes that China's ratio is much higher. However, merely dividing the home price by residential income can lead to biased outcomes; when using the price-to-income rate, we need to pay attention to the following issues. The first noteworthy thing is the property tax. We know that the United States always has a property tax; however, China has not yet begun to levy the property tax, although it was in the spotlight in the past two years and is ready to take effect. Therefore, when we compare the price-to-income ratio of China to that of the United States, from a rigorous point of view, removing the U.S property tax is a necessity.

The housing price-to-income ratio is a commonly used index to measure regional price level. Studying the ratio of house price to income in our country's key cities, we can see that the price-to-income ratio in Beijing is 25, Shanghai is 24, and Shenzhen is the highest at 38. The price-to-income ratio of first-tier cities in China has increased sharply from 19 in 2015 to 25 in 2016 at an astonishing pace. In contrast, in the United

States, the average rate in first-tier cities in 2016 was only about 9. The rate of the United States ten years ago could not reach our current level.

As discussed above, we can also take into account the factors of property tax and household income growth. Allowing for these two factors, we conclude that the residents in first-tier cities in China need their sixteen-year income to own an apartment; while the residents in the first-tier cities in the United States need only nine-year income to buy a house. As a gap between developing and developed countries, the difference is beyond expectation. Therefore, even if we take into consideration the disturbing items, such as property tax and the growth rate of household income, China's current price-to-income ratio is still at a relatively high level compared to the rest of the world.

Table 1 Comparison between the China and U.S. price-to-income ratio

	House price to income ratio (2016)	Adjusted House price to income ratio (2016)	House price to income ratio (2016)	Adjusted House price to income ratio (2016)	Sale and rental ratio	Population (10,000)	Income per capita ($1000)
Beijing	25.03	16	33.32	19	1.5%	2170	8.1
Shanghai	24.13	15	30.91	18	1.3%	2420	8.1
Shenzhen	38.47	20	38.36	20	1.1%	1140	6.9
New York	9.91	9	16.42	12	3.9%	860	61.4
Los Angles	9.54	9	7.89	7	3.5%	1010	50.7
San Francisco	10.31	9	12.23	10	3.1%	850	72.4
Source	CEIC	Lincoln Institute of Land Policy	Numbeo	CEIC	CEIC	CEIC	CEIC

In terms of specific practices, this paper assumes that the household income in first-tier cities will grow at a rate of 8% for 15 years. We make this assumption based on the average value, which implies that China's economy is to maintain rapid growth in the future without significant systemic risks. If there is a big economic crisis or market fluctuation, the income growth rate is required to be higher than 8%. Looking back at the 40 years since the reform and opening up, we observe that our country has developed at a rate substantially exceeding the world's average. Although it has experienced several considerable crises in the middle, the overall high growth trend is not affected. From the beginning of this year, the market view on the global economy has been not that optimistic. Under the background of deleveraging, private enterprises are more and more pressured to survive. People have low willingness to consume, and consumption degradation is in its shape. If there is a substantial change in the disposable household income in the next ten years, the difference may lead to sizable market

fluctuations.

If the household income cannot sustain at 8% growth rate, then the home price-to-income ratio in the first-tier cities in China is likely to jump above 20. If some crisis occurs and the income growth rate declines, adjustments will take place in the real estate market - the examples of the check-outs tide this year and the aggregate price cuts of real estate companies are all unheard of in the previous years.

In summary, the upsurge in real estate prices exerts a significant impact on China's residential sector, and the sector's marginal leverage ratio is rising rapidly. Considering factors including the rapid growth in the population of Chinese residents and the property tax in the United States, China's housing price-to-income ratio is still much higher than the rest of the world.

Comparing the national balance sheets of different countries, we can observe that the real estate assets account for a large proportion of Chinese residents' assets; while the total assets of the residents are too small, so the asset and liability are not balanced. We can conclude that the rapid rise in real estate prices has imposed significant challenges to resource allocation and social stability.

As for the corporate sector, from the data (as shown in the figure below), we observe that the industrial added value is closely related to housing prices. The relationship is understandable, as the real estate sector develops with the economy. In the primary industry classification, the real estate industry correlates to a variety of sectors (Xu Xianchun, 2015). It seems that stimulating the economy by developing the real estate sector is often used as an economic tool. While the main cost of real estate is the cost of land (Moritz et al., 2017), the increasing cost of land inevitably raises the real estate price. However, this point of view is plausible, and we will discuss it in the later chapter.

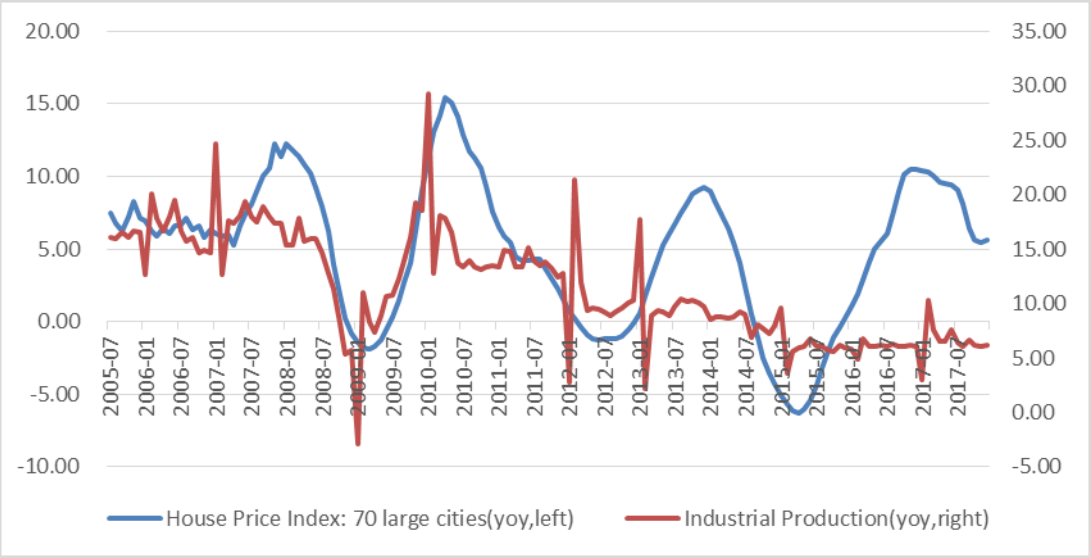


Figure 2 Industrial added value V.S. housing price

Source: National Bureau of Statistics

It seems evident that the increase in fiscal revenue results from the housing price surge (Figure 3). The rationale is also very intuitive- high housing price will push up the cost of land. As the land acts as one critical tax source of the government and even the most essential tax source of the local government, the increase in the cost of land can further raise the government's fiscal revenue.

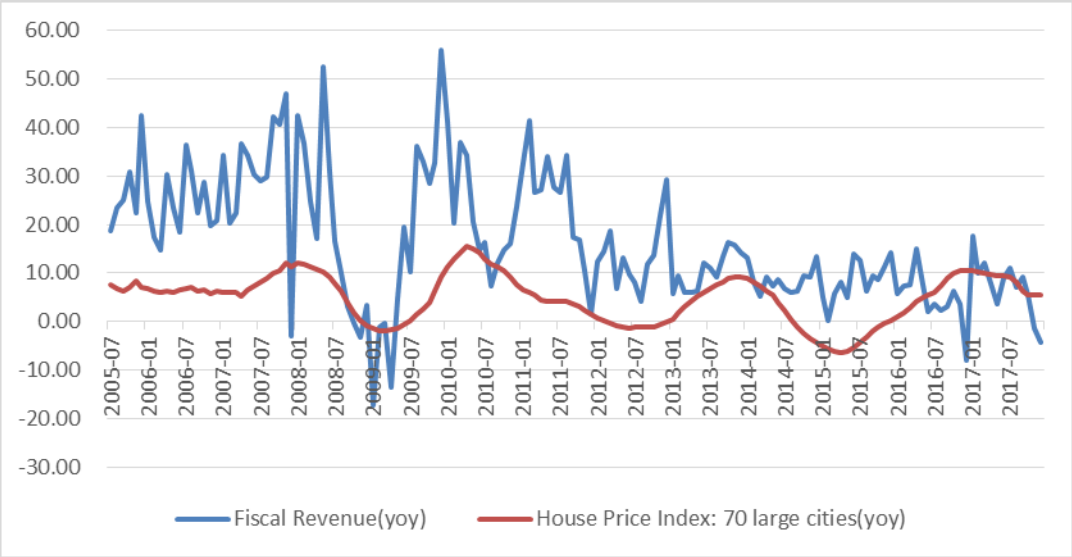


Figure 3 Fiscal income and housing prices

Source: National Bureau of Statistics

2. Literature Review

2.1 Long-term relationship between home prices and economic growth

As the starting point of the research, this chapter first discusses the long-term relationship between housing prices and economic growth.

From the current research findings, the relationship between China's real estate market and the economy is more complicated than that of European and American countries (Yan Xiandong and Ju Dixing, 2016). Generally speaking, people think that increased housing price is a natural outcome of economic growth. Land and factory buildings are essential production factors, and housing is a necessity for the living; therefore, house prices increase following the economic growth. However, examining a longer historical trend, this is not the case. Stevenson (2000) and Learner (2007) showed that although GDP boosts in the short term, the noteworthy jump in housing prices will lead to long-term inflation. From the empirical data, there exists a positive relationship between housing price volatility, industrial output, and inflation (Tang Zhijun, Xu Huijun, Ba Shusong, 2010). At the same time, fluctuations in house prices will also cause cyclical changes at the macroeconomic level through the wealth effect [1] and the balance sheet effect [2] (Bernanke and Gertler, 1989; Airaudo, Nistico and Zanna, 2015, etc.).

There has been little research on the relationship between long-term home prices

and economic growth. Knoll et al. (2017) summarized the price trends in 14 developed economies between 1870 and 2012 and found that house prices did not adhere to the pattern of economic growth. Before the First World War, the growth rate of housing prices in these 14 developed economies fluctuated within a narrow range. Since then, the average house price has declined due to the war. It was not until the 1960s that house prices had returned to pre-World War I levels. In the 1970s, the home prices in these 14 economies began to rise, with an average annual growth rate of 2% (excluding inflation). While the average yearly growth rate of the home price in those economies before World War I was around 0% (Chart 2.1).

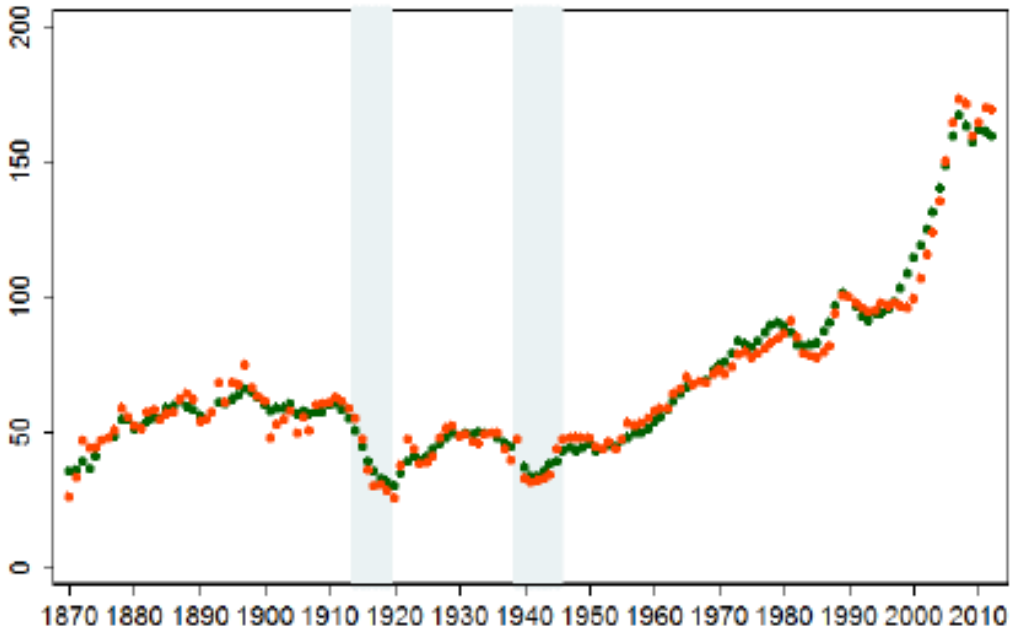


Figure 2.1 Average (median) real house price index for 14 developed economies: 1870-2012

Source: Knoll et al. (2017)

Their researches displayed the following rules. Firstly, the relationship between urbanization and housing prices is not that simple. Over the past 140 years, urban and rural housing prices have changed simultaneously. Secondly, from the accounting perspective, the cost of land is the most critical component of the housing price, and it does not depend on whether the land is state-owned or private-owned. Thirdly, the relationship between house prices and economic growth is not linear. After the 1970s, the growth rate of house prices (excluding inflation) was significantly higher than that of economic growth. The slowdown in land supply and the increased willingness to spend on housing are considered to be the main reasons for the price surge. The reason for the slowdown in land supply is that cities have effective borders, but the authors did not explain further why the willingness to spend on properties increased.

For China, the "monetization of housing allocation" policy that began in 1998 is generally considered to be the dawn of China's commercial housing reform. On July the 3rd, 1998, the "Notice on Further Deepening the Reform of Urban Housing System

and Accelerating Housing Construction" issued by the State Council changed the primary rule of housing allocation from physical distribution to monetizing allocation. Since then, China started to have relatively reliable property price statistics.

Since we only have 20-year data of China's commercial house prices, it's hard to tell whether the home price surge would have accelerated under an extended period. The table below shows the change in China's average house price from 1999 to 2017. The housing system reform was first implemented in 1999, with the national average sales price being 2053 RMB. In 2016, this figure rose to 7476 RMB, and the average annual compound growth rate was 7.9%.

However, the statistics are severely distorted. According to the "Statistical Communiqué on 2009 National Economic and Social Development", issued by the National Bureau of Statistics in 2010, the average annual growth rate of home prices in 70 large and medium-sized cities was 1.5%. The publish caused an uproar, because, by various means of calculations, National house prices should have risen by more than 20% in 2009 (21st Century Business Herald, 2010). The confusion directly led the National Bureau of Statistics to amend on the method of gathering home price statistics in early 2011. After that, the Bureau of Statistics released the 100-city housing price index and the 70-city new residential price data. The following table shows the comparison of the original price statistics and the 100-city housing price index. We discover that the old data systematically underestimate the national average selling price by about 50%. However, the new and the old indexes do not differ much in terms of growth rate.

The compound growth rate of the four first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen) reached 10.9% from 2011 to 2017, which was significantly higher than that of the 100-city home price index. The housing price surge generally refers to the rising costs in these four cities. In terms of both the absolute price level and the average annual growth rate, the prices in the four first-tier cities are clearly above the national average standard. Therefore, when it comes to high housing price, it is necessary to distinguish between the price in the four major cities and the national average level.

Table 2.1 Changes in national housing prices: 1999-2017

	National average home sales price	100-city Price Index	100-city Price Index: first-tier cities
1999	2053		
2000	2112		
2001	2170		
2002	2250		
2003	2359		
2004	2714		
2005	3168		
2006	3367		

2007	3864		
2008	3800		
2009	4681		
2010	5032		
2011	5357	9712	22124
2012	5791	9715	22604
2013	6237	10833	27903
2014	6324	10542	28065
2015	6793	10980	32891
2016	7476	13035	40621
2017		13967	41202
Compound growth rate	7.9%	6.2%	10.9%

Source: National Bureau of Statistics, China Index Institute
Note: The unit is RMB.

2.2 Study on the short-term relationship between housing prices and economic growth

Although few studies focus on long-term trends, there are many studies discussing the relationship between global real estate prices and economic growth in the last ten years. After the 2008 global financial crisis, the real estate prices fluctuated greatly worldwide, and the linked household consumption and bank credits showed unprecedented changes. This chaos made home price a hot issue (Mian and Sufi, 2014; Shiller, 2009; Case and Quigley, 2008).

Many opinions suggest that the loose monetary policy after the financial crisis resulted in a sharp rise in real estate prices (Adamand Woodford, 2013). In fact, before the financial crisis, there were studies discussing the impact of monetary policy on real estate prices (Goodhart and Hofmann, 2008; Del Negro and Otrok, 2007; Leamer, 2007).

Other studies, in turn, focus on the impact of housing price shocks on the economy. Mishkin (2012) believes that the increase in asset price carries wealth effects and promotes consumption. Meanwhile, the banks relax their credit constraints on households and businesses due to wealth accumulation, which can further boost consumption and stimulate the economy. In fact, since the 2008 financial crisis, the United States and some countries in Europe have indeed used quantitative easing to promote asset prices, and hence to vitalize the economy (Bernanke, 2012). However, many studies suggest that this approach will distort resource allocation at some point, thereby reducing total factor productivity and slowing down economic growth. Luo Zhi and Zhang Chuanchuan's research found that rising asset prices reduced resource allocation efficiency in the manufacturing industry, which is detrimental to the economy. Besides, Chen Yanbin and Liu Zhexi (2017) constructed a DSGE model factoring in the market expectation. They pointed out that though pushing up asset

prices can encourage market participants to purchase more assets, it will hurt the investment in the real economy. Moreover, the financing restrictions will further escalate this squeeze. Their calibration test found that a 10% increase in asset prices would reduce economic output by 0.8%.

2.3 Research on Land Finance with "Chinese Characters"

Although real estate can exert a massive impact on many economies (Kuan Junjun and Liu Shuixing, 2004), China has a unique policy of land financing which does not apply to other countries and regions. Land finance and housing prices are often bound by public social opinion and considered as the objectives of criticism. However, whether land finance always plays the role of pushing up housing prices is worthy of scrutiny. The land finance system provides incentives for local governments to inflate housing prices, but the mechanism and effectiveness behind the policy are not visible. Moreover, we cannot ignore the land finance policy when discussing real estate issues, so we need to do a study to comb this kind of research.

Land finance is a unique policy with typical "Chinese characteristics." At present, domestic mainstream academic circles have made a detailed discussion on the causes of land finance. There are two leading viewpoints - some scholars believe that land finance is a forced and helpless policy. With the reform of the tax-sharing system, the financial power of the local governments weakened when they failed to make adequate adjustments; hence, many local governments sank into severe financial deficit. To make up for the budgetary deficit, local governments had to use the "land finance" approach. The separation of fiscal and political power and the land finance caused by the tax-sharing system brought about a steady increase in home prices (Zhang Shuangchang and Li Daokui, 2010). Wang Ju, Lyu Chunmei, and Dai Shuangxing (2008) focused on the changes in local government fiscal revenues and expenditures after the tax-sharing reform. They think it is getting harder for the local governments to stop from excessively depending on the real estate sector to recover from financial distress. Local governments have various approaches to push up the cost of land and to drive up home prices; for example, they can acquire the land at a lower than the market price and then sell it at a much higher price. On the other hand, this approach also increases construction tax and real estate tax, thereby increasing the fiscal revenue of local governments from various aspects.

The article by Chen Zhiyong and Chen Lili (2009) more strikingly suggested that "land finance" fundamentally explains why the local governments would keep the housing market hot after the housing crisis since 2008. The study of Zhou Bin and Du Liangsheng(2010) constructed a general equilibrium model and pointed out that land finance will inevitably promote the continuous rise of housing prices. At the same time, it will also hurt the residents' utilities, and in turn, will lead to public dissatisfaction. The results of the Granger causality test also found that land prices can explain the changes in real estate prices for five quarters.

3. Variables and data

We select seven variables in this paper, namely, real estate prices, industrial added value, fiscal revenue, money supply, interest rates, real estate supply, and US industrial output. We first explain the considerations and contents of each variable.

3.1 Variable 1: Real estate price

There are three indicators of national real estate prices, namely the 100 cities residential price index (from now on referred to as the 100-city Price Index), the 70 large- and medium-sized cities new residential price index (from now on referred to as the 70-city Price Index), and the housing sales price index. Among them, the 100-city Price Index was published by the China Index Academy, covering the real estate prices of the 100 major cities in the country. It is the most-cities-covered price index system in China, and it can be dated to June 2011. The 70-city index was released by the National Bureau of Statistics, covering the real estate prices of 70 large and medium-sized cities across the country. The issuing institution is more authoritative, while its coverage is slightly smaller than the 100-city Price Index; and there is only a slight difference between the two indices. The index can be dated to July 2005. The new home sales price index is also created by the National Bureau of Statistics and is the predecessor of the 70-city Index. It was used from the 1st quarter of 1998 to December 2010.

Compared with the 70-city index, the 100-city index covers more cities while includes a shorter period which is only half the length of the 70-city index. Considering that the two indices differ in absolute values but display identical trends (Figure 4.), here we choose the 70-city Index with a longer time span as an indicator of the home price.

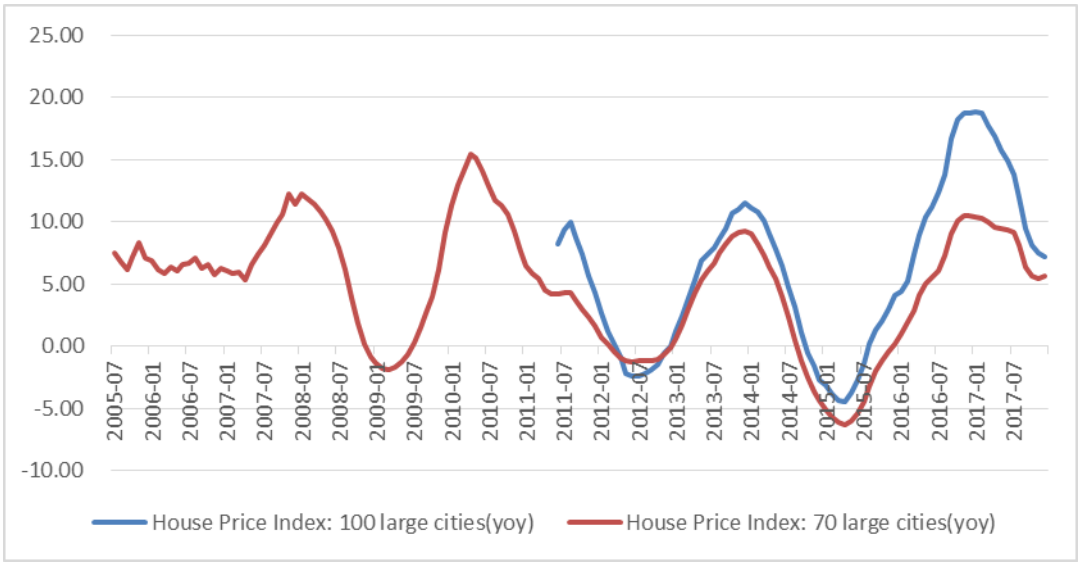


Figure 4 100-city Price Index and 70-city Price Index

Source: China Index Academy, National Bureau of Statistics

The 70-city index and the new home sales price index have the same indications, and their values are very close (Figure 5). Ideally, we can combine these two indicators to construct a real estate price index with an extended period. The problem is that the 70-city index was in use from July 2005; before that, we only had quarterly home price data but no monthly data. The measurement frequency is inconsistent with the monthly rate selected by the article, so we do not consider the combination. Moreover, the period coverage of the 70-city index is sufficient for the model of this paper, and the lack of the part before 2005 is not significant.

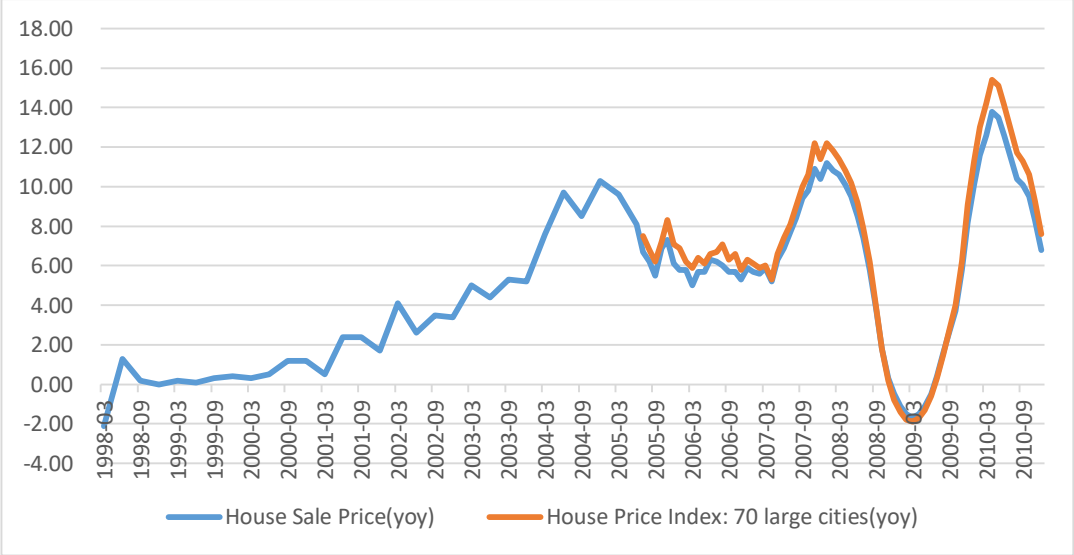


Figure 5. 70-city Index and New Home Sales Price Index

Source: National Bureau of Statistics

3.2 Variable 2: Industrial added value

Industrial added value is used here as a surrogate for economic growth. In general, if we apply monthly data to the model, then the standard practice is to use industrial added value as a proxy for GDP growth rate. In most periods, the industrial added value is consistent with GDP growth (Figure 6). Among them, some random spikes and troughs of industrial added value are results from the Spring Festival effect in January and February. This article will make seasonal smoothing in the subsequent empirical analysis.

The durable consistency between industrial added value and GDP can also help explain why the real estate's stimulus on economic may not be reflected in the industry sector but other sectors. There is a possibility that pushing up the property prices may only vitalize the real estate and construction sectors. Thus, although the contribution of real estate on the economy is reflected in GDP, it is not reflected in industrial added value.

If this possibility stands correct, it is unreasonable to use industrial added value as an alternative to economic growth. However, the high degree of consistency between the following two figures suggests that this concern is senseless. Industrial added value and GDP have a highly synchronized nature. If an industry can drive GDP, the

industrial added value will inevitably exhibit the increase.

The reason for this synchronization is that although the real estate directly stimulates the construction sector (Xu Xianchun, 2014), while the industrial sector does not straightly reflect the stimulus, these directly driven industries will bring in more or less industrial demand. As a result, industrial growth responded accordingly. Of course, the premise of this discussion is that the real estate industry does have a sustained pulling effect on economic growth.

Figure 6 Industrial added value and GDP

Source: National Bureau of Statistics

3.3 Variable 3: Money supply

The measure of the money supply is generally M1 or M2. In general, M2 is a better indicator because residents' deposits are strongly liquid. However, this article chooses M1 because it has a stronger correlation with the real estate prices, as observed from the simple graphical relationship (Figure 7).

In the period before 2013, the correlation between M1 and M2 and the 70-city Index was robust. However, since 2014, the relationship between M2 and 70-city Index has become weak, whereas the strong correlation between M1 and 70-city Index still maintained.

The weakening of the correlation between M2 and real estate prices is mainly due to the rise of shadow banking. The main difference between M2 and M1 is residents' deposits. With the development of financial markets, bank financing, new funds that allow quick cash realization, and P2P platforms have attracted a large number of deposits. After 2013, despite deposits grew at a steady pace, shadow banks expanded rapidly, which is closely related to the increase in real estate price; but it is challenging to observe this from the M2 data.

M1 is different; both the traditional deposit and shadow bank will merge into M1 when the credit restraints relax. In this way, though credit expansion may not be

reflected in M2, it will always be absorbed by M1; we can observe this from the figure below.

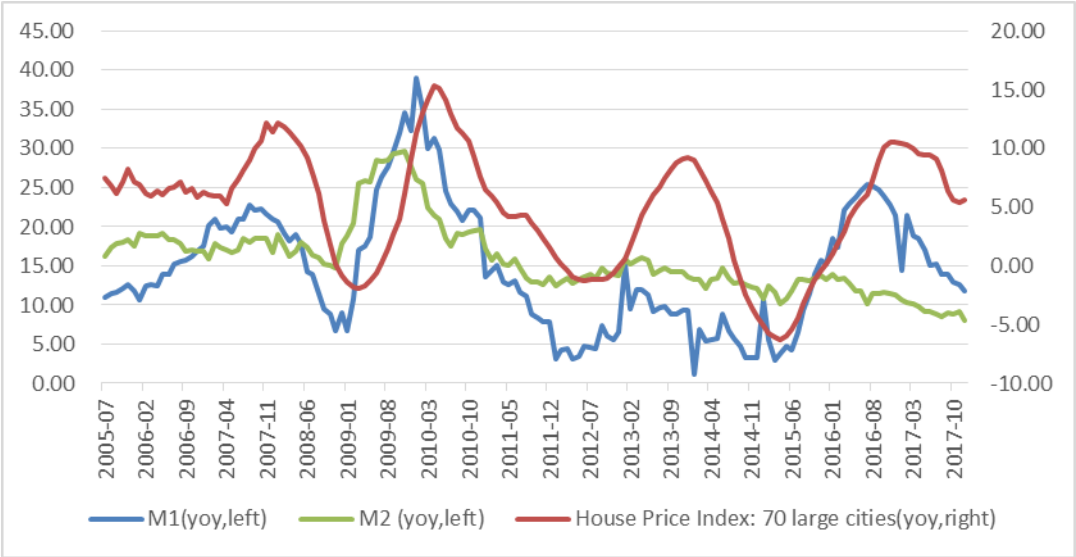


Figure 7. M1, M2, and 70-city Index

Source: People's Bank of China, National Bureau of Statistics

3.4 Variable Four: Interest Rate

There are also many interest rate indicators, such as deposit and loan benchmark interest rates, interbank market repo rates, Shibor, investment yields, government bond yields along with others. These indicators apply to different markets. The prime rates for deposits and loans apply to banks' making credit loans; the repo rate, Shibor, and government bond yields apply to the interbank market; and the investment yields should apply to shadow banks. How to choose the appropriate interest rate indicator requires a detailed discussion.

If the data frequency is annual, then the benchmark interest rate is the best choice. Because whether it is the interbank market or the shadow bank, the changes in the applicable rates are all based on changes in the benchmark interest rate. However, for empirical studies whose data frequency is monthly, the benchmark interest rate merely changes from month to month. For a long time, the benchmark interest rate remains unchanged, but the monthly rate volatility is substantial (Figure 8).

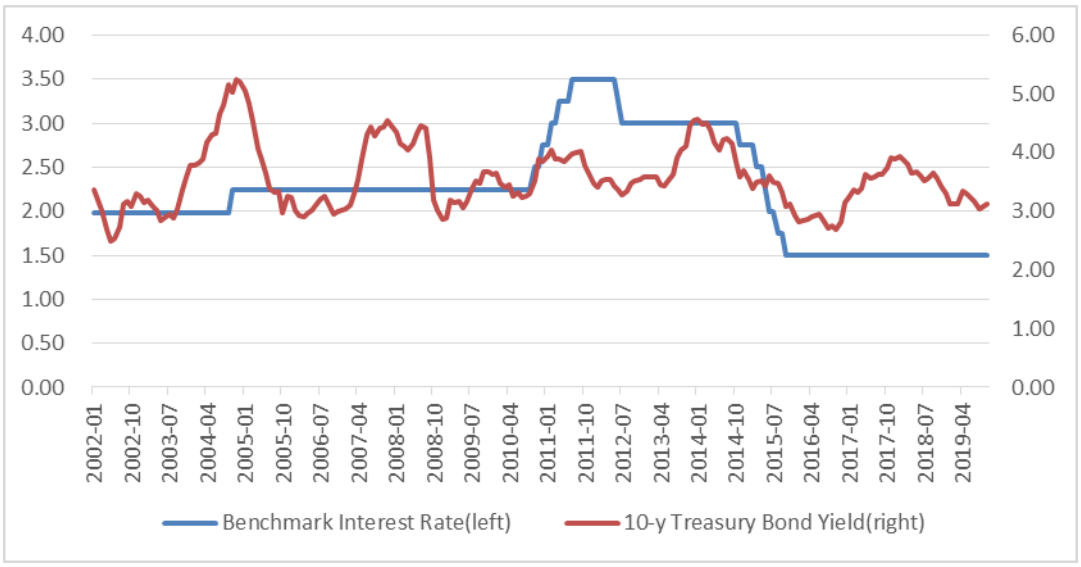


Figure 8 Benchmark interest rate and 10-year government bond yield

Source: People's Bank of China, China Bond Information Network

Undoubtfully, if the fluctuations of the market interest rate do not affect the financing rate of the real economy, then it is not necessary to worry about the rate volatility. However, from the data shown in the chart below, interest rate fluctuations in financial markets affect both direct financing (debt issuances) and indirect financing (bank loans). Thus, although the benchmark interest rate may not change, the interest rate fluctuations in the financial market may have already affected the financing cost of the real economy. Insisting on applying the benchmark interest rate will bring about biased estimation outcomes (Figure 9).

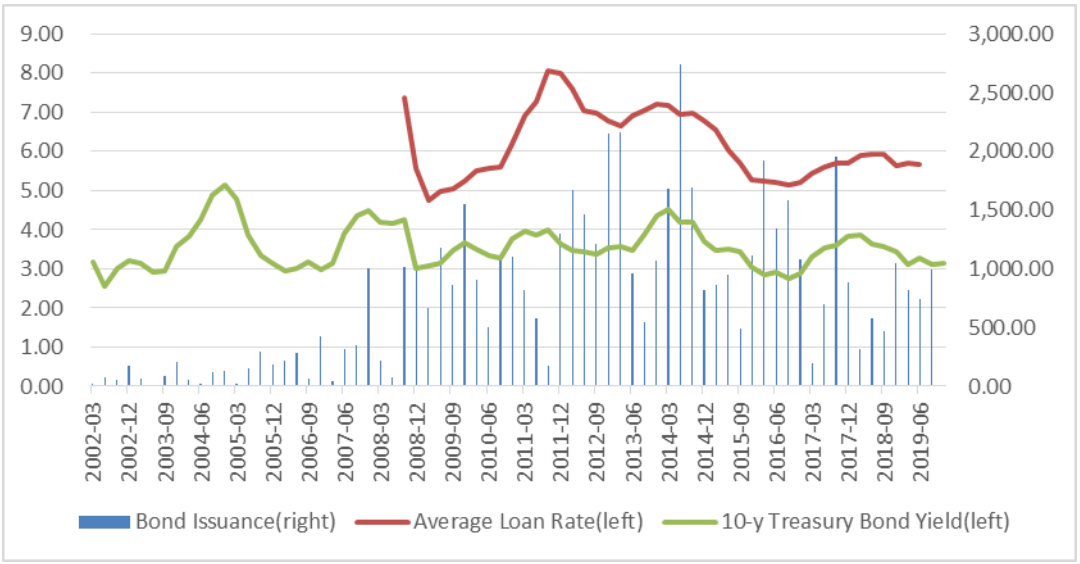


Figure 9 Financial market interest rate and real economy financing interest rate

Source: People's Bank of China, China Bond Information Network

Among the different indicators, we need to choose the most appropriate variable to characterize the rate change. The data in the figure below shows that the changes in the several optional indicators are very similar; the only difference is the time length and volatility of the data.

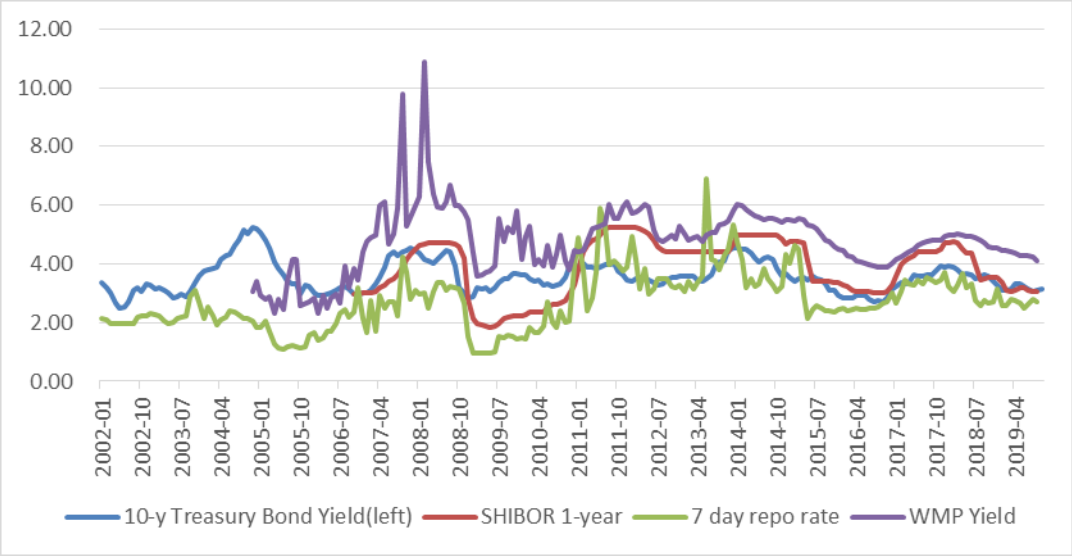


Figure 10 Comparison of market interest rate trends and fluctuations

Source: China Bond Information Website

The table below displays a comparison of the time length and volatility of these four interest rate indicators. The fluctuations in Shibor, 7-day repurchase rate, and investment return are significantly higher than those in the benchmark interest rate and government bond yield. This difference reflects that the financial market itself is highly volatile. Such large fluctuations have produced a lot of noise, which is not conducive to us to discuss the relationship between interest rates and real estate, economy, and finance. Therefore, in the later empirical analysis, we still choose the 10-year government bond yield as an indicator of the interest rate. As a robustness test, we present in the appendix the empirical results obtained using other rates as indicators; and these results are not significantly different from the ones in the main body of the paper.

Table 2. The descriptive statistics of the four interest rates

Name	Time zone	Mean value	Standard deviation
Benchmark interest rate	1989-2017	2.55	0.69
10 years treasury bond	2002-2017	3.58	0.58
SHIBOR：1 year	2006-2017	3.86	1.03
7 days repurchasing rate	1999-2017	2.66	1.03
1 year investment return	2004-2017	4.80	1.17

Note: The comprehensive investment yield has been adjusted smoothly to eliminate extreme values.

3.5 Variable Five: Real Estate Supply

Another critical point to discuss is the real estate supply indicator. Technically speaking, it is difficult to accurately measure the supply of real estate because the saleable real estate statistics are incomplete. On the other hand, a not-for-sale property can readily convert to ready-for-sale one. However, we still try to find an indicator that can closely depict the real estate supply.

There are three commonly used indicators for housing area: construction area, new construction area, and completed-construction area. The table below gives the definitions, coverages, and sizes of these three indicators. These three indicators are independent but slightly overlapping. The construction area includes the new in-progress construction area starting from the previous period, the in-progress or completed-construction area that recovers from the last period of a work stoppage, and the stopped or suspended construction area that starts from the current period; and this indicator has the most extensive coverage. The coverages of newly launched and completed areas are smaller than that of the construction area. Of course, these two indicators also include some space that the construction area indicator does not cover. For example, 50% of a building with 50% completion in the current period should be included in the building area according to the construction area index. However, for the newly constructing indicator, 100% of its building area is covered, and the completed area indicator include 0% of the building area.

From this comparison, we can find that the construction area is most suitable indicator of the real estate supply; because the newly built area includes the yet-to-build part, and the completed area does not consider the completed-contruction space.

Of course, the home supply changes over time. As technology advances, the building construction cycle will become shorter and shorter, and the measurement difference between the three indicators will be smaller and smaller. However, in terms of monthly data, the difference is always significant. So this article still chooses the construction area as an indicator to measure the housing supply.

It is worth noting that many real estate construction projects use the pre-sale method. Before the unit project completes construction, many houses have already been sold. We generally refer to these pre-sold houses as the “forward delivery housing." However, it brings about computational problems. If these “forward delivery housing” are not circulating in the housing market, the real estate supply measured by the construction area overestimates the actual value. However, it is unreasonable to exclude these properties completely, because a large proportion of them still circulate in the housing market even if they have already been sold. In contrast, the construction area is still a relatively accurate indicator.

The following figure shows the comparison of the three commonly used indicators- the construction area, new construction area, and completed-construction area. We can tell that the absolute value of the construction area is far higher than that of the other two indicators. This is consistent with the coverages of the three indicators mentioned above. For semi-finished projects, although the coverage of the new construction area is more extensive than that of the construction area, since construction

area covers a lot more other items, the total construction area is much broader than the other two measurements.

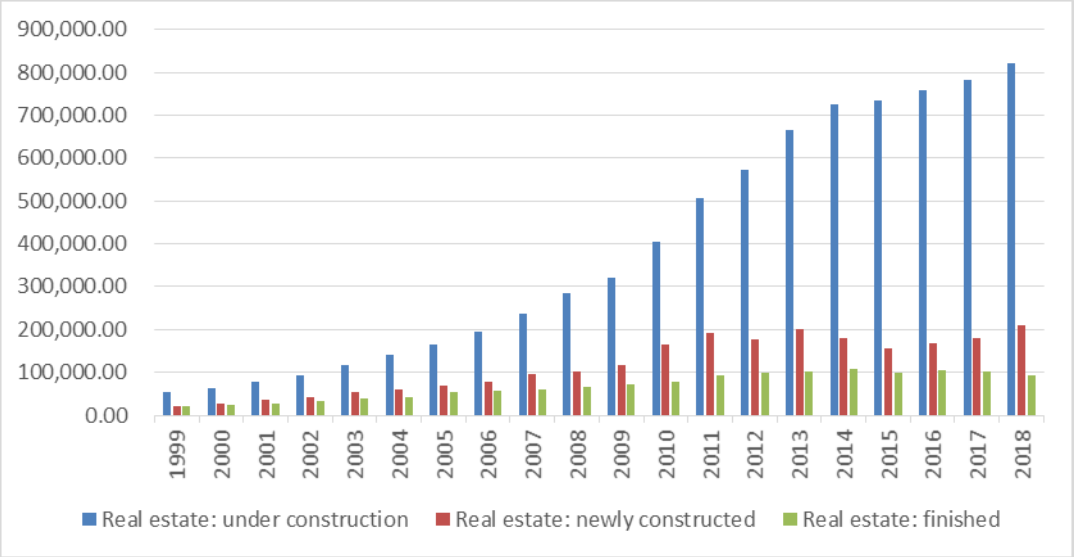


Figure 11. Comparison of the three Indicators

Source: National Bureau of Statistics

Note: The unit is 10,000 square meters.

3.6 Variable Six: U.S Industrial Output

Using the U.S industrial output as a surrogate for external demand is also a common approach in current researches. Firstly, the United States is the world's largest economy; secondly, the economic growth of various countries has been highly synchronized in the past 20 years. Therefore, it is feasible to use the U.S indicator as a proxy of the global demand.

In summary, we carefully select each variable in this paper based on its pros and cons. Due to the limited data, it is difficult to obtain accurate real estate measurements- this is always a challenge in the study of real estate. However, the parameters selected in this article are as close as possible to the actual values under the ideal situation. To verify the robustness of the results, we present a large number of empirical findings of other alternative indicators in the appendix to confirm the analytical results in the main body.

4. Methods and results.

4.1 Description of the empirical test method

If the time series variables selected in this paper are all stable, we use a simple VAR model to perform the empirical analysis. However, in general, the macroeconomy-related time series variables are often non-stationary, before the empirical analysis, we first test the stability of the variables.

Table 4 Unit root test result

	Statistics	1% threshold	5% threshold	10% threshold
Industry added value	-1.463	-3.499	-2.888	-2.578
Financial revenue	-2.493	-3.498	-2.888	-2.578
Real estate price index	-1.054	-3.498	-2.888	-2.578
D. Industry added value	-13.299***	-3.499	-2.888	-2.578
D. Financial revenue	-11.626***	-3.498	-2.888	-2.578
D. Real estate price index	-6.301***	-3.498	-2.888	-2.578

4.1.1 This paper uses the orthogonal VECM model.

Standard VECM model is in a simplified form with a drawback that it does not incorporate the process of orthogonalization. It implicitly assumes that all the random error terms in the VECM model are independently and identically distributed, and the assumption is deemed too strong and unreasonable.

To improve on this disadvantage, the advanced VECM model applies orthogonalization, and the random errors are partially exogenous. It assumes that for all the variables included in the model, at least one is perfectly exogenous, and the left n-1 variables are affected by this variable. Then for the rest of the n-1 variables, again at least one of them is exogenous, and the other n-2 variables are dependent on this new exogenous factor... The process continues until we include all the variables. In the end, we can rank the n variables according to their exogenous degree, and the error part of each variable is split into its own random error and the disturbance caused by other variables.

Mathematically speaking, once we know the exogenous order of the variables, we can create a new VECM model by orthogonalizing the matrix.

4.1.2 This article adopts the lower triangular constraints matrix.

In the VECM model, the ranking of variables has important implications. In general, the variables that are listed in the first places are more exogenous than the variables that are ranked later, and the first variable is the only perfectly exogenous one. Based on this common ground, this paper further uses the impulse response function and orthogonalizes this function to separate random errors. Therefore, we can assess the effects of disturbing terms individually.

Another issue that needs explanation is the order of the variables. Since we examine China's real estate prices, the variables related to the United States, such as the U.S industrial added value, are relatively less affected by the China-focused variables. Therefore, the U.S industrial added value can be regarded as the most exogenous variable, so we put it in the first place.

Monetary policy is generally regarded as an exogenous shock, so this article puts M1 and r (interest rate) before other variables. Of course, some studies suggest that

monetary policy is also partially endogenous. It is reasonable to remove the endogenous part of the factor and leave its exogenous impact (Bernanke et al., 1999). However, due to the limited publicly available information and data, this article still uses a mature approach which is to treat the monetary policy as entirely exogenous. This approach will not have a directional impact on the results of this paper. Also, since there is no means to separate the exogenous disturbances from the monetary policy, we can simply use the fiscal policy data as proxy.

When ordering the variables, the construction area ranks after external demand and monetary policy, but before industrial added value, real estate prices, and fiscal revenue. The reason why it is positioned before the last three variables is as follows: the housing construction generally takes two years, although the sequence is becoming shorter, it still far exceeds the lagging period of the model. Therefore, we regard the construction area as a relatively exogenous factor.

There are many discussions about the causal relationship between the three factors- industrial added value, real estate prices, and fiscal revenues. The literature review section also provides a summary, so we will not go into detail here. The model of this paper sets the ranking of these variables to be industrial added value - fiscal revenue - real estate price. The right-handed factor affects the variable on the left but does not influence the more right-handed one. This order is fixed mainly for the convenience of the research-if we treat the real estate price as exogenous, we can directly study the impact of real estate price shock on economic growth and fiscal revenue. Of course, this assumption is somewhat rough, but there is no consensus from the previous literature, so this paper cannot rely on any existing theory.

For the sake of robustness, we show the impulse responses if we rank the variables in the other two ways, and the results are double confirmed. In summary, ranking in a different order does not affect our primary conclusions, but changes the significance of the test results.

4.1.3 As mentioned above, the constraints matrix used in this paper is as follows:

$$\begin{bmatrix} u_{ip\_us} \\ u_{m1} \\ u_r \\ u_{fs} \\ u_{GR} \\ u_{rpi} \\ u_{vay} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{ip\_us} \\ \varepsilon_{m1} \\ \varepsilon_r \\ \varepsilon_{fs} \\ \varepsilon_{GR} \\ \varepsilon_{rpi} \\ \varepsilon_{vay} \end{bmatrix}$$

Table 5 Cointegration rank test results

Maximum	Number of parameters	MLR	Unit root	trace statistics	5% threshold
0	15	-772.346	.	47.9072	34.55
1	20	-755.03	0.22481	13.2747*	18.17
2	23	-750.115	0.06973	3.4442	3.74
3	24	-748.393	0.02501		

Note: After considering the time trend, there is still no cointegration relationship between the two. Due to the limited space of this paper, we omit the result.

Table 6 the VAR lag order

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1186.77				10344	17.7578	17.7842	17.8227
1	-780.154	813.24	9	0	27.3746	11.8232	11.9286	12.0827
2	-743.599	73.11	9	0	18.1483	11.4119	11.5965*	11.8661*
3	-732.651	21.896*	9	0.009	17.638*	11.3829*	11.6465	12.0316
4	-724.389	16.524	9	0.057	17.8512	11.3939	11.7366	12.2373

Table 7 VAR regression results

	(1)	(2)	(3)
VARIABLES	svay	srpi	sGR
L.svay	0.615***	0.107	0.838**
	(0.0910)	(0.0819)	(0.414)
L2.svay	0.293***	0.0364	0.292
	(0.101)	(0.0912)	(0.461)
L3.svay	0.0347	-0.130*	-0.432
	(0.0849)	(0.0763)	(0.386)
L.srpi	0.276***	1.368***	0.497
	(0.0945)	(0.0850)	(0.430)
L2.srpi	-0.300*	-0.151	-0.115
L2.srpi	(0.159)	(0.143)	(0.722)
L3.srpi	0.0340	-0.273***	-0.447
	(0.0953)	(0.0857)	(0.434)
L.sGR	0.0793***	-0.00804	0.776***
	(0.0212)	(0.0190)	(0.0963)
L2.sGR	-0.0238	-0.00457	-0.149
	(0.0262)	(0.0235)	(0.119)
L3.sGR	-0.0397*	0.00891	0.0390
	(0.0214)	(0.0193)	(0.0976)
	(1)	(2)	(3)
VARIABLES	svay	srpi	sGR
Constant	0.266	0.181	-2.365
	(0.338)	(0.304)	(1.539)
Observations	135	135	135

Note：Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.14 Results:

Granger causality test results show that real estate prices and government revenues are Granger reasons for economic growth. The relationship between government revenue and economic growth is easy to understand. Since high government income enables the government to provide various infrastructure and public services, thus enhancing local competence. The relationship between the home price and economy seems to make sense- the high property price can stimulate real estate investment and vitalize the economy. However, the problem is that the excessive prosperity of the real estate will squeeze the manufacturing industry, and the negative effect from the squeeze will become more and more significant. Whether the real estate industry can pull the sustainability of the economy has been doubtful.

Table 8 the Granger causality test results

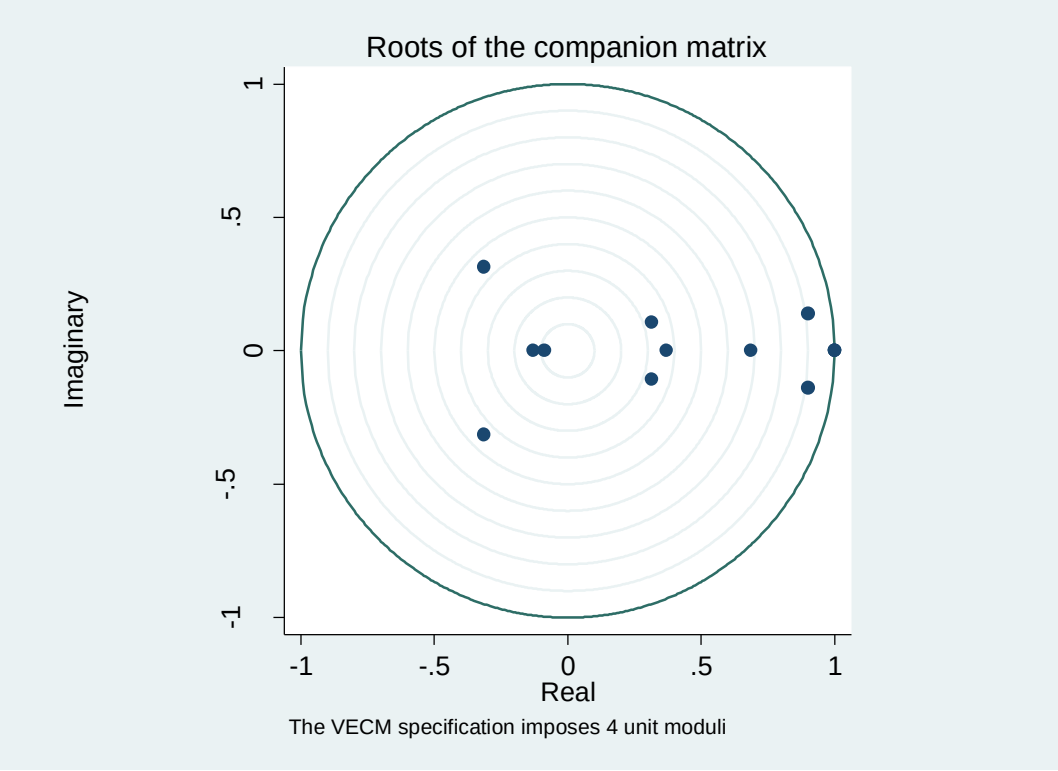
Equation	Excluded	chi2	df	Prob > chi2
svay	srpi	9.9142	3	0.019
svay	sGR	18.05	3	0
svay	ALL	39.246	6	0
srpi	svay	3.6517	3	0.302
srpi	sGR	0.4698	3	0.925
srpi	ALL	3.7921	6	0.705
sGR	svay	12.106	3	0.007
sGR	srpi	4.6319	3	0.201
sGR	ALL	15.616	6	0.016

Table 9 Cointegration test results

Maximum	Number of parameters	MLR	Unit root	trace statistics	5% threshold
0	63	-1481.79	.	198.3877	136.61
1	76	-1453.21	0.3432	141.2171	104.94
2	87	-1428.04	0.30932	90.8867	77.74
3	96	-1408.62	0.24846	52.0409*	54.64

4	103	-1396.07	0.16856	26.9366	34.55
5	108	-1389.16	0.09655	13.1277	18.17
6	111	-1384.08	0.07201	2.964	3.74
7	112	-1382.6	0.02156		

Figure 12 VEC featured root test results



4.2 Empirical test explanation

The VEC model requires determining the appropriate lag order for each variable. However, there is currently no means to determine the lag order specifically for the VEC model. Mathematically speaking, if a set of variables are cointegrated, the VEC model must its VMA, VAR, and VECM representations (Granger Representation Theorem). In this way, we can use VAR to determine a lag order, and then reduce the order by one; then we can get the lag order in VECM form. The mathematical rationale is that if the model's lag order obtained by VAR representation is p, then after converting to VECM representation, all variables will present in the difference form, and the new variable is inherently one order lower than the variable in VAR representation. The two descriptions are the same, so then we choose p-1 to be the lag order of the new model.

The following table reports the VAR lag order. That the maximum lag order selected here is four is because of the following two reasons. Firstly, increasing the lag

order can lose more degrees of freedom. China's economic data generally do not date back long, so it is challenging to choose a higher lag order. Secondly, the lag order beyond four can help little on improving the accuracy of the model fitting, so there is no need to add more orders.

Even if considering only the prediction accuracy, having more lag orders is not good either. The more the lag orders, the more historical information is being used, the smaller the weight of new details. In many cases, the model using much past information does not predict as accurate as the model using the most recent inputs.

The table below shows the test results for the lag order. Among them, FPE represents the minimum prediction variance, while AIC, HQIC, and SBIC are respectively three information criteria. After comparison, the second-order lag test results are the best, as all FPE, AIC, and HQIC favor this order. The four information criteria reject the results of the 3rd and the 4th order lags, which also shows that to continue adding the lag order has little significance.

Table 10 the VAR lag order

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-2493.99				38000000	37.3282	37.3897	37.4796
1	-1478.34	2031.3	49	0	20.8325	22.9007	23.3928	24.1117*
2	-1383.2	190.3	49	0	10.5207*	22.2119*	23.1346*	24.4826
3	-1348.96	68.466	49	0.034	13.305	22.4323	23.7856	25.7626
4	-1305.75	86.431 *	49	0.001	14.9119	22.5186	24.3026	26.9086

Granger causality test results show that for economic growth, pushing up real estate prices will not lead to an increase in industrial added value, and the impact of external demand, represented by U.S industrial output, is also limited. Interest rate, money supply, and government revenue are all Granger reasons for industrial added value. This is in line with our intuitive perception as the first two are monetary policies, which obviously have an effect on economic growth. While under the “spending determining consumption” system, the increase in government revenue also implies an increase in government spending, so the rising fiscal revenue drives economic growth in a similar way as the expansionary monetary policy.

The housing construction area is a substitute indicator of real estate supply. This variable is not the Granger reason of the property price, indicating that the short-term real estate construction does not affect the housing price. We require a detailed explanation for this. In general, changes in the supply of goods impact the changes in commodity prices unless the price elasticity of demand for products is infinite; this is the fundamental economic theory. Real estate is not a commodity with infinite price elasticity, so the reduction in supply should raise its price level. However, we can't get this conclusion from our model, mainly because the housing construction area is not a perfect indicator of real estate supply. In practice, after completing construction, the house will not immediately convert into a ready-to-sell property. The conversion often takes one or two years, as the time depending on the developer's expectation on the sales situation. In some cases, even some partially built properties can become for-sale

houses; and a small number of completed homes may become not-for-sales forever, such as relocation houses and developers' self-sustaining properties.

Due to such defects in the construction area of the house, it cannot be used as a perfect indicator of the real estate supply. Therefore, in the regression analysis, we could not observe how the construction area affects the property sales price. In theory, the ready-for-sale housing area best indicates the real estate supply, though the data is currently unavailable. The construction area is the best alternative variable in the optional data. Considering that the supply-side variable being vacant will bring about the missing variable problem, we still substitute an available alternative data into the regression equation as a controlled variable.

For real estate prices, the monetary factors, including interest rate, money supply M1, are the Granger reasons, while industrial added value, international demand, government revenue, and housing construction area are not. This shows from the side that the most effective means of regulating real estate prices is through monetary policy-raising interest rates and imposing credit control can both help curb the housing price.

Other variables, including interest rate and money supply, are not being extensively discussed, so the results of the Granger causality test using these factors as explanatory variables are not presented in this paper. However, we still performed Granger tests with these variables, with details in the appendix.

Table 11 Granger causality test

Equation	Excluded	chi2	df	Prob > chi2
svay	srpi	0.59758	2	0.742
svay	ip_us	1.9376	2	0.38
svay	r	11.542	2	0.003
svay	sGR	6.6135	2	0.037
svay	sfs	2.2743	2	0.321
svay	m1	59.932	2	0
svay	ALL	133.39	12	0
srpi	svay	1.0981	2	0.578
srpi	ip_us	1.3148	2	0.518
srpi	r	5.0626	2	0.08
srpi	sGR	1.8658	2	0.393
srpi	sfs	2.4841	2	0.289

srpi	m1	7.9255	2	0.019
srpi	ALL	32.021	12	0.001

4.3 Empirical test results

The table below showed the VEC regression results. The explained variable in column (1) is the differenced form year-on-year growth rate of the industrial added value (the following variables all refer to the differenced form variables). The results in the first three rows are cointegration equations, which we do not discuss in detail here. The coefficient of the first order lagging industrial added value is negative, indicating that the high growth in the previous period will exert pressure on the later stage, and this accords with our intuitive understanding. The impact of real estate prices on economic growth is not significant, which aligns with the previous Granger causality test results.

After controlling other factors, the insignificance result suggests that real estate prices have not helped much in growing the economy. The impact of government revenues on economic growth is also not notable. This intimates that it is ineffective for the government to rely on tax collection to provide infrastructure and to drive economic growth. Among other controlled variables, the interest rate and M1 have clear impacts on economic growth. Their coefficients are significantly positive, indicating that the expansionary monetary policy does have an active promotion effect on economic growth. The effect of U.S industrial output on China's economic growth is not remarkable, meaning that external demand does not immediately influence domestic economic growth. Also, the impact of the housing construction area is not significant, so the implication is that the real estate supply is not the main factor affecting economic growth.

The explanatory variable in column (2) is the real estate price. The coefficient of the first-order lagging real estate price is significantly positive, which indicates that the financial asset price does have a positive feedback mechanism. It also demonstrates with other variables under control, the self-change in real estate price is likely to result in a bubble. Although the coefficient of industrial added value is positive, it is not significant. The implication is that economic growth does not necessarily lead to an increase in house prices. This conclusion is not in line with our intuition, and we will discuss this issue in detail in the other sections of this paper. The coefficient of interest rate is positive, but this also requires a more comprehensive discussion. If interest rate is purely exogenous, there is no doubt that the rate increase will put more pressure on residential mortgage, curb real estate demand, thus reduce house prices. The main problem here is that the interest rate can be endogenous, and the market rates reflect future expectations, making the estimation coefficient positive.

The explanatory variable in column (3) is government revenue. The impacts of most variables are not significant, perhaps because the mechanism of fiscal revenue is complicated and is hard to be explained by a single variable. However, the overall test is significant, meaning that the combination of these variables can still interpret the

government revenue.

The explanatory variables in columns (4)-(7) are the U.S industrial output, interest rate, housing construction area, and money supply. Since these are not the focus of this paper, the regression results will not be discussed in detail.

Table 12 VEC regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	D_svay	D_srpi	D_sGR	D_ip_us	D_r	D_sfs	D_m1
L._ce1	-0.0668*	0.0222	0.870***	0.0811	0.0168***	0.102	0.0519
	(0.0382)	(0.0417)	(0.198)	(0.0503)	(0.00646)	(0.113)	(0.0988)
L._ce2	0.00508	-0.0621***	-0.161**	-0.0185	0.000663	-0.137***	-0.114***
	(0.0133)	(0.0145)	(0.0690)	(0.0175)	(0.00225)	(0.0393)	(0.0344)
L._ce3	0.0315*	0.0184	-0.362***	-0.0319	-0.00883***	0.0150	0.0267
	(0.0175)	(0.0191)	(0.0908)	(0.0230)	(0.00296)	(0.0517)	(0.0452)
LD.svay	-0.244***	0.0712	-0.134	0.129	0.00448	-0.609***	-0.284
	(0.0721)	(0.0787)	(0.374)	(0.0949)	(0.0122)	(0.213)	(0.186)
LD.srpi	0.0408	0.322***	0.0873	0.181*	0.0122	-0.348	0.261
	(0.0792)	(0.0865)	(0.411)	(0.104)	(0.0134)	(0.234)	(0.205)
LD.sGR	0.0176	-0.0244	0.0598	0.0357	0.00785**	0.00554	0.00422
	(0.0191)	(0.0208)	(0.0989)	(0.0251)	(0.00322)	(0.0563)	(0.0493)
LD.ip_us	0.0903	0.109	0.677*	0.103	0.0190	0.401*	0.177
	(0.0695)	(0.0759)	(0.361)	(0.0915)	(0.0117)	(0.205)	(0.180)
LD.r	1.454***	1.237**	5.680**	-0.462	0.317***	0.178	3.320**
	(0.525)	(0.573)	(2.721)	(0.691)	(0.0886)	(1.549)	(1.356)
LD.sfs	0.0253	0.0313	0.118	0.0362	0.000274	0.00775	0.00541
	(0.0283)	(0.0309)	(0.147)	(0.0373)	(0.00478)	(0.0836)	(0.0732)
LD.m1	0.236***	0.0167	0.0795	-0.0261	2.37e-05	-0.113	-0.292***
	(0.0335)	(0.0366)	(0.174)	(0.0442)	(0.00567)	(0.0991)	(0.0867)
Constant	-0.0884	0.0326	-0.00846	0.0164	0.000852	0.000705	-0.0132
	(0.0735)	(0.0803)	(0.381)	(0.0968)	(0.0124)	(0.217)	(0.190)
Observations	136	136	136	136	136	136	136

As seen from the causality relationship, the increase in real estate prices does not help promote economic growth or increase fiscal revenue. So why is the government still keen on boosting real estate prices during the economic downturn? The impulse response shows that although raising the property price does not help grow economy or increase fiscal revenue in the long term, it is useful in the short term. The pulse response results show two crucial quantitative findings, which are as follows:

（1） Quantitative discovery 1: Increasing real estate prices have almost immediate effects on economic growth. The rising property price has a rapid positive conduction effect on industrial added value, and the impact reaches its peak five months after the pulse. It then gradually diminishes, and after 13 months the effect reduces to zero and then goes further to the negative range. The negative impact is found to be stable, and there is no apparent convergence even after 40 months.

（2） Quantitative discovery 2: The impact of real estate price pulse on fiscal revenue is similar to that on economic growth. The influence cycle is identical, but the budgetary revenue was affected slightly earlier with the impact peaking in 4 months and then beginning to decay. The impact on fiscal revenue diminishes more quickly than on economic growth. About 13 months after the impulse, the subsequent adverse effects can become very stable, and the negative impact can also last until the 40th month after the pulse.

From the results of the two impulse responses, raising real estate prices does have a short-term positive effect on economic growth and especially on government revenue. In this sense, lifting property prices is a useful practice when facing economic growth pressures or financial difficulties. The problem is that the subsequent adverse effects of rising property prices are long-lasting. On the whole, after a short prosperous period of 1 year or so, the negative impact of this move will last at least another three years or even longer.

Overall, whether it is for economic growth or fiscal income, the impression of lifting real estate prices is short-lived. Although economic growth and budgetary revenue will increase in the short term, in the long run, the rising property prices will exert a sustained adverse effect on both. In summary, there is no obvious significance in pushing up property prices. Considering the outcomes outside the model, such as social stability and suppression of innovation, raising property prices are even detrimental to economic growth and fiscal income.

4.4 Empirical Test Results Display

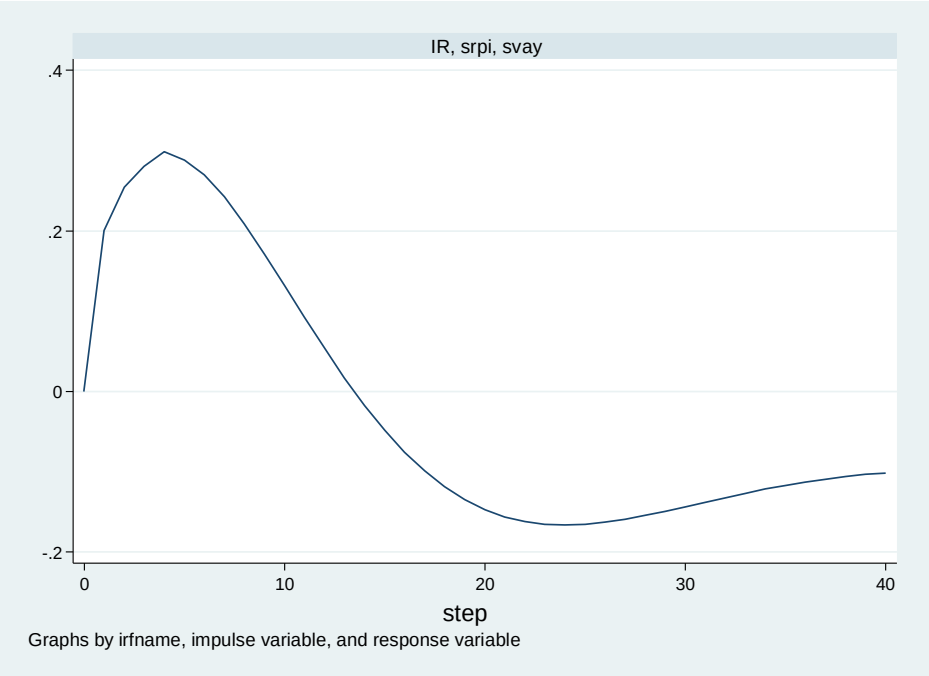


Figure 13. Pulse response – real estate prices impact on economic growth

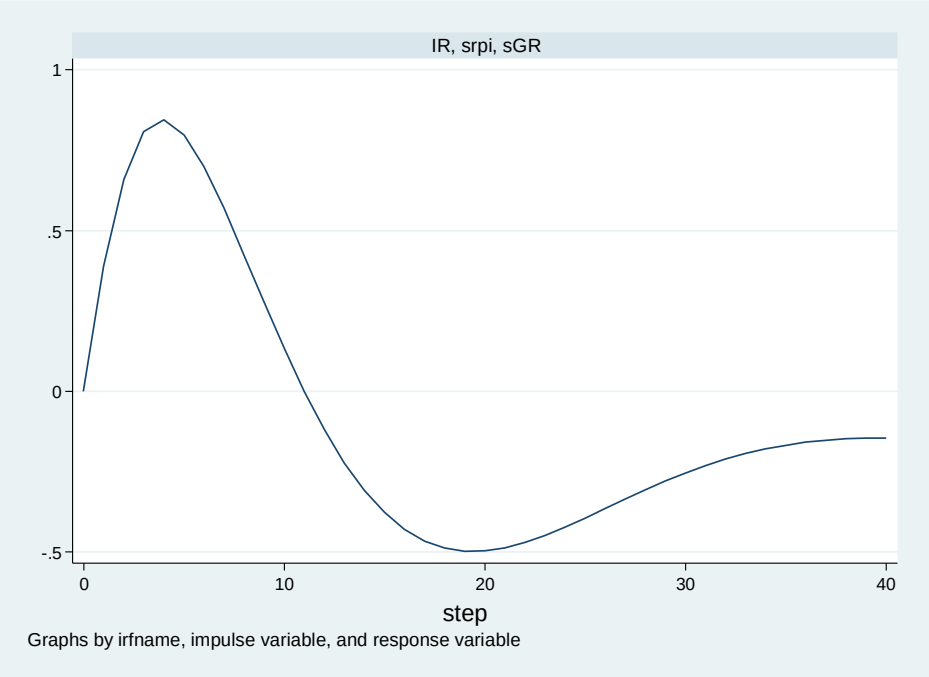


Figure 14. Impulse response – real estate prices impact on fiscal revenue

Table 13. Overall Granger causality test

Equation	Excluded	chi2	df	Prob > chi2
svay	srpi	0.59758	2	0.742
svay	ip_us	1.9376	2	0.38
svay	r	11.542	2	0.003
svay	sGR	6.6135	2	0.037
svay	sfs	2.2743	2	0.321
svay	m1	59.932	2	0
svay	ALL	133.39	12	0
srpi	svay	1.0981	2	0.578
srpi	ip_us	1.3148	2	0.518
srpi	r	5.0626	2	0.08
srpi	sGR	1.8658	2	0.393
srpi	sfs	2.4841	2	0.289
srpi	m1	7.9255	2	0.019
srpi	ALL	32.021	12	0.001
ip_us	svay	3.2252	2	0.199
ip_us	srpi	3.1696	2	0.205
ip_us	r	0.62341	2	0.732
ip_us	sGR	2.9814	2	0.225
ip_us	sfs	1.0999	2	0.577
ip_us	m1	5.3297	2	0.07
ip_us	ALL	24.447	12	0.018
r	svay	3.7707	2	0.152
r	srpi	1.1754	2	0.556

r	ip_us	3.8495	2	0.146
r	sGR	10.819	2	0.004
r	sfs	0.41979	2	0.811
r	m1	0.02404	2	0.988
r	ALL	19.38	12	0.08
sGR	svay	12.72	2	0.002
sGR	srpi	5.8985	2	0.052
sGR	ip_us	6.9626	2	0.031
sGR	r	14.178	2	0.001
sGR	sfs	1.0717	2	0.585
sGR	m1	6.9686	2	0.031
sGR	ALL	39.742	12	0
sfs	svay	8.6588	2	0.013
sfs	srpi	4.2274	2	0.121
sfs	ip_us	7	2	0.03
sfs	r	2.5937	2	0.273
sfs	sGR	0.39976	2	0.819
sfs	m1	5.1021	2	0.078
sfs	ALL	38.372	12	0
m1	svay	2.5209	2	0.284
m1	srpi	4.3854	2	0.112
m1	ip_us	9.6676	2	0.008
m1	r	7.0032	2	0.03
m1	sGR	0.42284	2	0.809
m1	sfs	1.5578	2	0.459
m1	ALL	50.255	12	0

4.5 Robustness test

Finally, to ensure the accuracy of the empirical analysis, we perform a robustness test in this section on the alternative or optional indicators of the interest rate. We base on the test conducted in the previous parts to further illustrate the conclusion. We perform the following two robustness tests:

(1) Use the benchmark interest rate as an alternative
(2) Use Shibor as an alternative

The model and method adopted for these tests are similar to the one in the previous chapter, so we will not repeat the analyses here. From the results of the chart, we can see that the trends and impacts are consistent with the conclusions reached in the main body. The test results are now sorted out for verification purposes.

(1) Robustness test 1: The benchmark interest rate replaces the 10-year government yield used in the main body. The results are as follows:

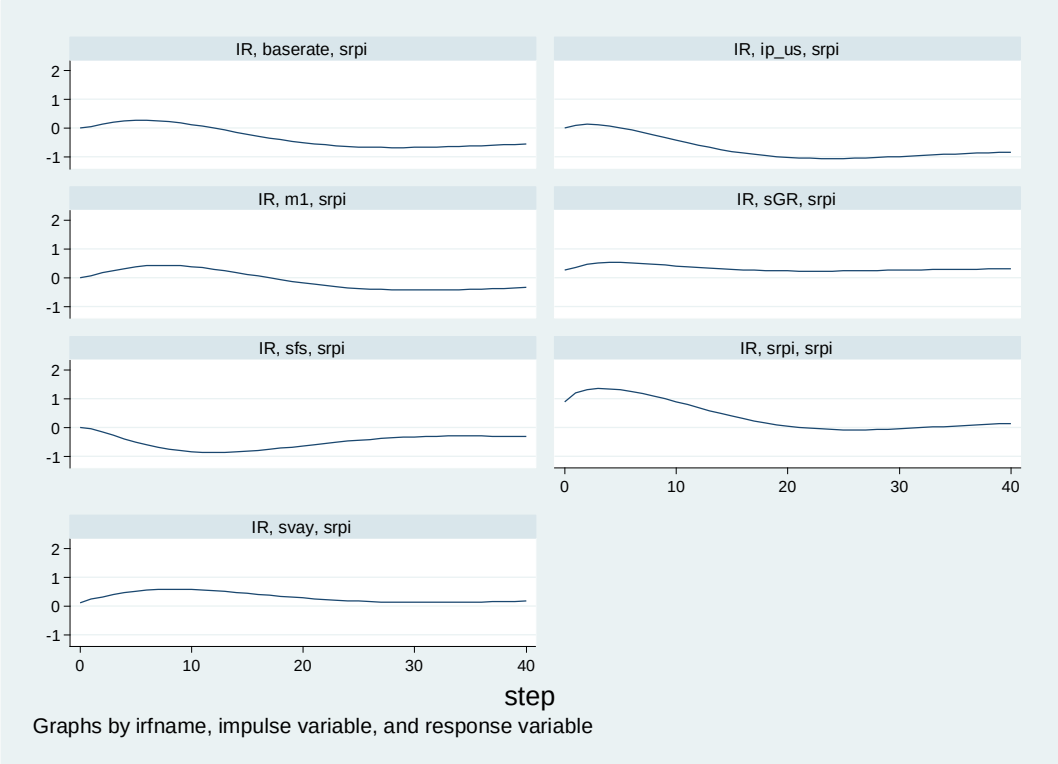


Figure 20 The pulse impact of the variables on real estate prices

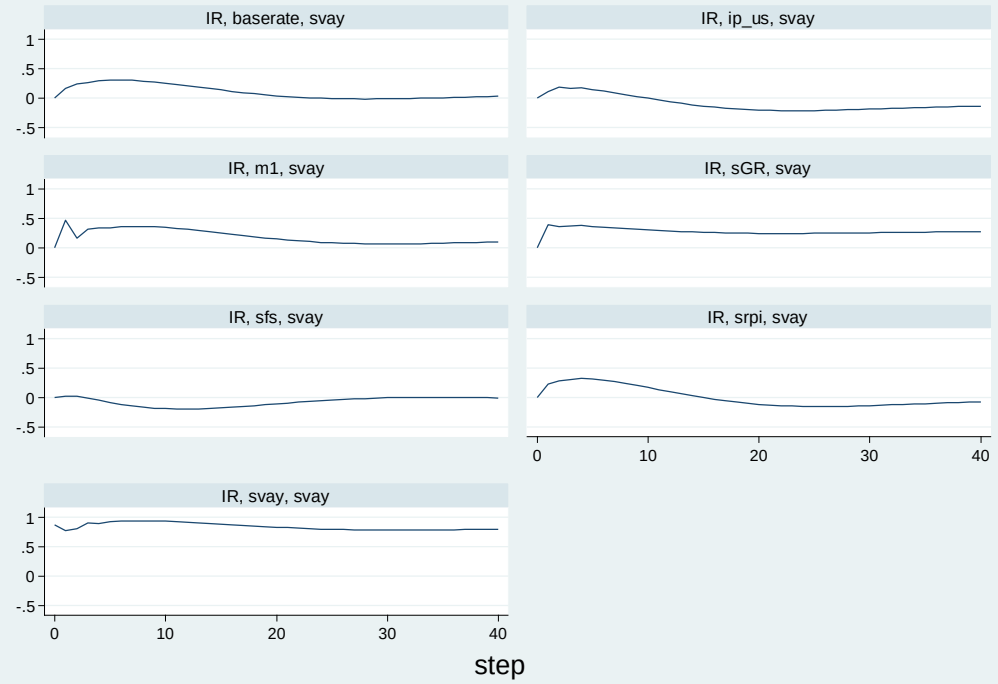


Figure 21 The pulse impact of the variables on industrial added value

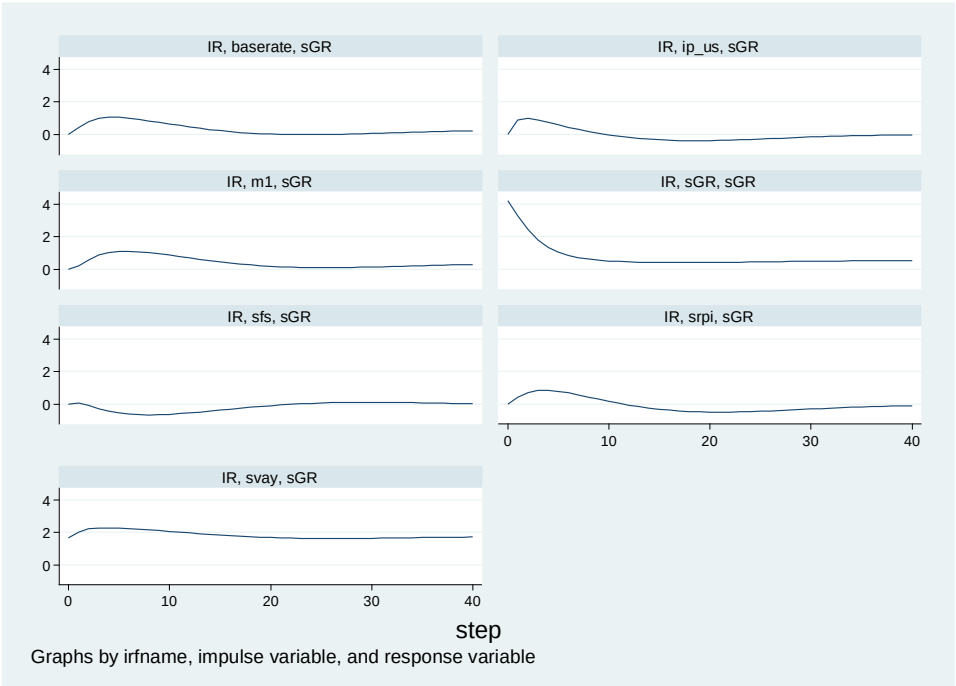


Figure 22 The pulse impact of the variables on fiscal revenue

(2) Robustness test 2: Shibor replaces the 10-year treasury bond yield used in the main body of the paper. The results are as follows:

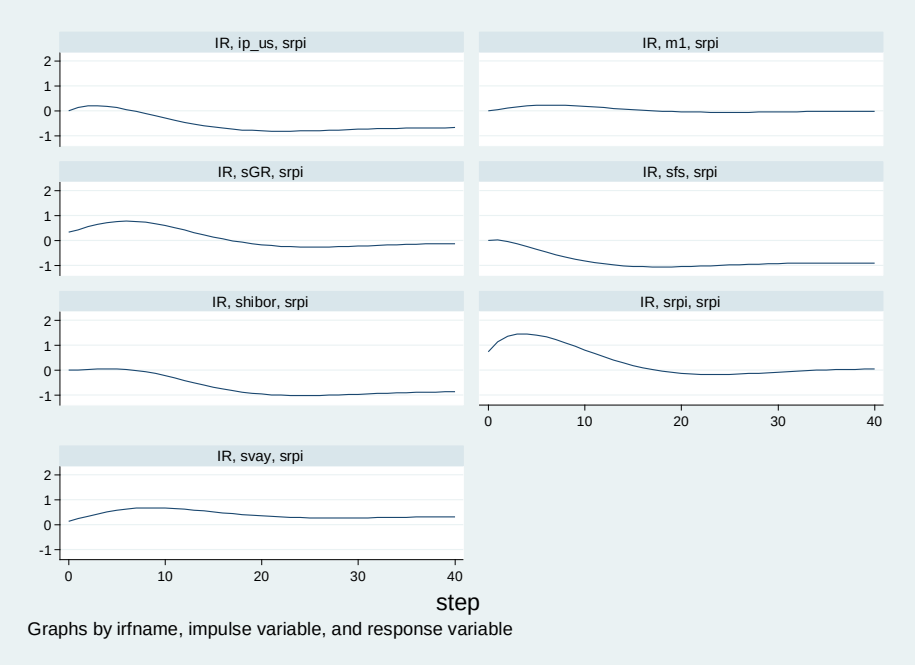


Figure 23 The impact of the variable pulses on real estate prices

5. Summary

From the results of the two impulse responses, raising real estate prices does have a short-term positive effect on economic growth and especially on government revenue. In this sense, lifting property prices is a useful practice when facing economic growth pressures or financial difficulties. The problem is that the subsequent adverse effects of rising property prices are long-lasting.

Through the empirical test in the last chapter, we can see from the quantitative analysis that the government pushing up the housing price for fiscal revenue and economic growth will achieve short-term prosperity of about one year. Then the negative impact of this move will last at least another three years or even longer.

The pulse response results show two crucial quantitative findings, which are as follows:

(1) Quantitative discovery 1: Increasing real estate prices have almost immediate effects on economic growth. The rise in real estate price has a rapid positive conduction effect on industrial added value, and the impact reaches its peak five months after the pulse. The force then gradually diminishes, and after 13 months it reduces to zero and then goes further to the negative range. The negative impact is found to be stable, with no apparent convergence after 40 months.

(2) Quantitative discovery 2: The impact of housing price pulse on fiscal revenue is similar to that on economic growth. The cycle is the same, but the fiscal revenue is affected slightly earlier with the impact reaching its peak in 4 month and then beginning to decay. The impact on fiscal revenue diminishes more quickly than on economic

growth. About 13 months after the impulse, the subsequent adverse effects can become very stable. Also, the negative impact can last until the 40th month after the pulse.

Overall, whether it is for economic growth or government revenue, the impression of lifting real estate prices is short-lived. Although economic growth and fiscal revenue will increase in the short term, in the long run, the rising property prices exert a negative and sustained adverse effect on both. In summary, there is no obvious significance in pushing up property prices. Incorporating the outcomes that are not considered in the model, such as social stability and suppression of innovation, raising property prices is even detrimental to economic growth and fiscal revenue.

References

[1]. Al-Alao B S, Parissis H, McGovern E, et al. Gender influence in isolated coronary artery bypass graft surgery: a propensity match score analysis of early outcomes[J]. General thoracic and cardiovascular surgery, 2012, 60(7): 417-424.

[2]. Alfaro L, Kalemli‐Ozcan S, Sayek S. FDI, Productivity and Financial Development[J]. World Economy, 2009, 32(1):111-135.

[3]. Aoki S. A simple accounting framework for the effect of resource misallocation on aggregate productivity ☆ [J]. Journal of the Japanese & International Economies, 2012, 26(4):473-494.

[4]. Baek J S, Kang J K, Park K S. Corporate Governance and Firm Value: Evidence from the Korean Financial Crisis[J]. Ssrn Electronic Journal, 2002, 71(2):265-313.

[5]. Bai Chong-En, Qing Liu, Wen Yao Investing Like China. Working Paper.

[6]. Bernanke B S, Gertler M, Gilchrist S. The Financial Accelerator in a Quantitative Business Cycle Framework[J]. Working Papers, 1998, 1(99):1341–1393.

[7]. Buera F J, Moll B, Shin Y. Well-Intended Policies[J]. Review of Economic Dynamics, 2013, 16(1):216-230.

[8]. Carlino G, Defina R. The differential regional effects of monetary policy: evidence from the U.S. States[J]. Journal of Regional Science, 1997, 39(2):339–358.

[9]. Chen J. The Effects of Mergers with Dynamic Capacity Accumulation[J]. International Journal of Industrial Organization, 2009, 27(1):92-109.

[10]. Cheremukhin A, Golosov M, Guriev S, et al. The Economy of People's Republic of China from 1953[J]. 2014.

[11]. Erkens D H, Hung M, Matos P. Corporate Governance in the 2007-2008 Financial Crisis: Evidence from Financial Institutions Worldwide[J]. Journal of Corporate Finance, 2012, 18(2):389–411.

[12]. Foster A D, Gutierrez E. The Informational Role of Voluntary Certification: Evidence from the Mexican Clean Industry Program[J]. American Economic Review, 2013, volume 103(3):303-308(6).

[13]. Hsieh C T, Klenow P J. Misallocation and Manufacturing TFP in China and India[J]. Social Science Electronic Publishing, 2009, 124(4):1403-1448.

[14]. Khan A, Julia K. Thomas. Credit Shocks and Aggregate Fluctuations in an Economy with Production Heterogeneity[J]. Journal of Political Economy, 2013, 121(6):1055-1107.
[15]. Lemmon M L, Lins K V. Ownership Structure, Corporate Governance, and Firm Value: Evidence from the East Asian Financial Crisis[J]. Social Science Electronic Publishing, 2001, 58(4):1445-1468.
[16]. Li X, Liu X, Wang Y. A Model of China's State Capitalism[J]. Social Science Electronic Publishing, 2015.
[17]. Michalopoulos C, Bloom H S, Hill C J. Can propensity-score methods match the findings from a random assignment evaluation of mandatory welfare-to-work programs?[J]. Review of Economics and Statistics, 2004, 86(1): 156-179.
[18]. Mitton T. A Cross-Firm Analysis of the Impact of Corporate Governance on the East Asian Financial Crisis[J]. Journal of Financial Economics, 2002, volume 64(02):215-241.
[19]. Ouyang M, Peng Y. The treatment-effect estimation: A case study of the 2008 economic stimulus package of China[J]. Journal of Econometrics, 2015, 188(2):545-557.
[20]. Paul R. Rosenbaum, Donald B. Rubin. Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score[J]. American Statistician, 1985, 39(1):33-38.
[21]. Ran Duchin, Denis Sosyura. The politics of government investment[J]. Journal of Financial Economics, 2012, 106(1):24-48.
[22]. Restuccia D, Rogerson R. Misallocation and productivity[J]. Review of Economic Dynamics, 2013, 16(1):1–10.
[23]. Robert G. Econometric Policy Evaluation - A Critique[J]. Journal of Monetary Economics (Supplement, 1976, 1:19–46.
[24]. Rosenbaum P R, Rubin D B. The central role of the propoensity score in observational studies for causal effects[J]. Biometrika, 1983, 70(1):41-55.
[25]. Solow R M. Heterogeneous Capital And Smooth Production-Functions - An Experimental Study[J]. Econometrica, 1963, 31(4):623-645.
[26]. Tong H, Wei S J. The Composition Matters: Capital Inflows and Liquidity Crunch during a Global Economic Crisis[J]. Nber Working Papers, 2009, 24(6):2023-2052.
[27]. Wong, C., 2011, The economic stimulus Program and Problems of Macroeconomic Management in China. Handouts on the 32nd Annual Meeting of OECD Senior Budget Officials.
[28]. Ziebarth N L. Identifying the Effects of Bank Failures from a Natural Experiment in Mississippi during the Great Depression[J]. American Economic Journal Macroeconomics, 2013, 5(1):81-101.
[29]. Zoellick, Robert B., and Justin Yifu Lin., 2009, Recovery: A Job for China and the US[N]. The Washington Post.