The Impact of Real Estate Equity Investment of Productive Enterprises on China's House Price Foam: Based on the State Space Mode

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Abstract: Based on the state space model, with the macro data of residential housing price, housing rent, land price, interest rate, consumer price index, nominal exchange rate and GDP, this paper measures the quarterly data of China's real estate price bubble in 2007-2016. We construct a theoretical model, analyze the theoretical mechanism of the impact of real estate equity investment behavior of production enterprises on China's housing price bubble, and then use the long-term equity investment data of non-financial non-real estate listed enterprises (ie, productive enterprises) investing in the real estate industry, to empirically test the impact of equity investment on China's housing price bubble, which is invested by production enterprises to real estate. The study found that: (1) After relaxing the "random perturbation" hypothesis of the housing price bubble, the average price of the house price bubble based on the state space model is not zero, which is consistent with the actual situation of the current real estate price in China; (2) The long-term equity investment of the production enterprise in the real estate industry extends the financing chain of the real estate enterprise, which increases the financing cost of the real estate enterprise, and finally raises the real estate price bubble level.

Keywords: Productive Enterprises; Capital Flows; Long Term Equity Investment; Capital Flows; House Price Foam; State Space Model

1. Introduction

In recent years, the scale of China's real estate industry has rapidly expanded, and real estate prices have risen rapidly. According to data released by the National Bureau of Statistics, the trend of housing prices nationwide was relatively stable before 2016. Since the second half of 2016, housing prices have significantly increased. In 2017, the average housing price in 100 cities in China was 11541 yuan/square meter, while in 2018, the average housing price in 100 cities was 12800 yuan/square meter, an increase of 10.9%. The rapid rise of real estate prices has led to the deviation of real estate prices from the actual value, resulting in a real estate price foam, while the real estate price foam in the first tier cities with large increases is large [1]. We should use the influence of major economies and the internationalized People's Currency to actively influence global capital flows for our own use, avoid being "sheared off", and become the main beneficiaries of global capital flow [2].

The contributions of this paper are: First, it separates the real estate price bubble from real estate prices using a state-space model, expanding the research methods of real estate price bubbles. Second, it regresses the real estate price bubble on the total amount of long-term equity investment in the real estate industry by NFRE listed companies, finding that investment in the real estate industry by non-real estate entities inflates the real estate price bubble. Third, it provides empirical evidence using micro data of NFRE listed companies [3], finding that long-term equity investment in the real estate industry increases enterprises' over-financing from the banking system. This over-financing at the macro level crowds out loan fund sources in real estate development investment, thereby raising the financing costs of real estate investment development and inflating the real estate price bubble.

2. Literature Review

2.1 Measurement of Real Estate Bubbles

Scholars mainly measure the real estate price foam from two aspects: building indicators and statistical testing. In selecting indicators to build real estate price foam indicators, Zhou & Sornette used super indexes to build real estate price foam indicators in the United States and Britain [4], and Case & Shiller used the relationship between personal income and house price to build real estate price foam indicators [5]. Due to the subjectivity of the weight setting of different variables, the method of building the foam indicator of real estate price with indicators has major defects. For example, Li et al. used the expert scoring method to determine the indicator weight [6], resulting in the lack of scientificity of the foam indicator of real estate price. In terms of using statistical testing methods to build real estate price foam indicators, on the research of measuring China's real estate price foam, Shao et al. used the rise of land price to measure the real estate price foam [7], Lv & Liu used fiscal variables to measure the real estate price foam based on the SGMM method [8], and Wang et al. built a new Keynesian DSGE model that includes both commercial and real estate sectors [9]. Using the parameters of the Bayesian estimation model, we examined the mechanism of China's real estate price and output (quantity) fluctuations, focusing on the impact of monetary policy on real estate prices. Meng & Rong tested and measured China's housing price foam with the nonlinear econometric model Markov variable model [10].

2.2 Real Estate Equity Investment and Real Estate Bubbles

As for the research on the relationship between real estate equity investment and real estate price, some scholars believe that capital flowing into real estate enterprises through financial intermediaries will lead to foam in real estate prices. [11] The study found that the generation of real estate price foam is generally related to the financing of real estate enterprises by the financial system. [12] The study found that the influx of a large number of funds into the real estate industry is an important reason for the formation of the real estate price foam. [13] It is believed that speculative expectations are an important reason for the influx of funds into the real estate industry and the birth of the real estate price foam. [14] It is believed that the overheated real estate industry has experienced a rapid price rise, which has led to a higher rate of return on real estate investment, thus attracting more non real estate enterprises to invest, and will further push up the foam of real estate prices.

In terms of measuring real estate bubbles, the aforementioned scholars analyzed real estate bubbles based on residual items, and when using econometric models for regression, they based their analysis on the overall distribution of residual items with a mean of zero. Therefore, a common problem in these studies is that the mean of the measured real estate bubble is zero, implying that along with the bubble, there must be market housing prices below normal value, which does not match reality. Therefore, this paper measures real estate bubbles based on a spatial econometric model, effectively addressing this issue. Regarding the impact of real estate investment on housing price bubbles, scholars generally believe that a large influx of capital into the real estate industry leads to a rise in real estate prices, thereby creating a housing price bubble. However, there has been little research on the impact of investment in the real estate industry by non-real estate sector companies on real estate bubbles. This paper analyzes the impact of investment in real estate by productive enterprises on real estate price bubbles, enriching the literature on real estate bubble measurement and providing policy recommendations for solving the "real estate destocking" issue.

3. Theoretical Analysis

3.1 NFRE Real Estate Equity Investment and Housing Price Bubbles

Enterprises are divided into real estate and non-real estate enterprises. Both types of entities invest capital, labor, and intermediate products in production, assuming they use the same Cobb-Douglas production function:

$$Q_{i,t} = A_{i,t} K_{i,t}^{\alpha_i} L_{i,t}^{\beta_i} M_{i,t}^{1-\alpha_i-\beta_i} \quad (1)$$

Where $K_{i,t}$ $L_{i,t}$ $M_{i,t}$ represent capital, labor, and intermediate inputs, respectively, $A_{i,t}$ represents production technology, α_i β_i represent the output elasticities of capital and labor, respectively. Without loss of generality, the product market in which the enterprise operates is assumed to be perfectly competitive, and the enterprise's demand function is as follows:

$$Q_{i,t} = \psi_{i,t} P_{i,t}^{-1/\eta_i} \quad (2)$$

Where $\psi_{i,t}$ represents a stochastic disturbance factor, $P_{i,t}$ represents product price, $\eta_i \in (0,1)$ represents the inverse of the price demand elasticity.

Considering the enterprise's production decision problem, Let $\omega_{i,t}$ and $m_{i,t}$represent the prices of labor and intermediate inputs, respectively, then the enterprise's optimal production decision for maximizing profit $\pi_{i,t}$ is as follows:

$$\pi_{i,t} = \max_{L_{i,t},\ M_{i,t}} \left\{ Y_{i,t} - \omega_{i,t} L_{i,t} - m_{i,t} M_{i,t} \right\} \quad (3)$$

Among them, $Y_{i,t} = P_{i,t}Q_{i,t}$ represents the sales revenue of goods, which can be obtained by solving the first-order condition:

$$\pi_{i,t} / Y_{i,t} = \eta_i + \alpha_i - \alpha_i \eta_i \quad (4)$$

From the envelope theorem, we derive the profit function:

$$\pi_{i,t} = Z_{i,t}^{\ \gamma_i} K_{i,t}^{\ 1-\gamma_i} \quad (5)$$

Among them,

$$\gamma_i = 1 - \alpha_i (1-\eta_i) / \left[\eta_i + \alpha_i (1-\eta_i) \right] \quad (6)$$

$$Z_{i,t} = \left(\eta_i / \gamma_i\right)^{1/\gamma_i} \left[\left(1-\eta_i\right)^{1-\alpha_i} \left(\beta_i / \omega_{i,t}\right)^{\beta_i} \left(\left(1-\alpha_i-\beta_i\right) / m_{i,t} \right)^{1-\alpha_i-\beta_i} \right] X_{i,t} A_{i,t}^{\ 1/\eta_i - 1} \quad (7)$$

The income function can be obtained from equations (4), (5), and (6) as follows:

$$Y_{i,t} = \gamma_i / \eta_i \, Z_{i,t}^{\ \gamma_i} K_{i,t}^{\ 1-\gamma_i} \quad (8)$$

Assuming that adjusting the capital stock of a company does not require cost, the capital adjustment equation is:

$$\hat{K}_{i,t+1} = \left(1-\delta\right) K_{i,t} = \left(1-\delta\right)\left(\hat{K}_{i,t} + I_{i,t}\right) \quad (9)$$

$\hat{K}_{i,t}$ is the capital at the beginning of period t, $I_{i,t}$ is the newly added investment, $K_{i,t}$ is the capital stock, δ is the capital depreciation rate, $\hat{K}_{i,t}$ and $K_{i,t}$is different in that one is the time point capital and the other is the period capital.

Solving the optimal investment decision of a company through the stochastic Bellman equation:

$$V(Z_{i,t}, \hat{K}_{i,t}) = \max_{I_{i,t}} \left\{ \pi\left(Z_{i,t}, \hat{K}_{i,t}; I_{i,t}\right) - P_{i,t}^{K} I_{i,t} + E_t \left[V(Z_{i,t+1}, \hat{K}_{i,t+1}) \right] / \left(1+r\right) \right\} \quad (10)$$

Where P_t^K is the price of using capital, and by solving the first-order condition, we obtain the optimal investment rate:

$$I_{i,t} / K_{i,t} = \left[\left(1-\gamma_i\right) / \left(1+\tau_{i,t}\right) J_t \right]^{1/\gamma_i} \left(Z_{i,t} / K_{i,t}\right) - 1 \quad (11)$$

Where τ_i represents the additional cost rate of capital, reflecting the differential loan interest rates faced by different enterprises. J_t represents the Jorgensonian user cost of capital:

$$J_t \equiv P_t^K - \left[\left(1-\delta\right) / \left(1+r\right) \right] E_t \left[P_{t+1}^K \right] \quad (12)$$

In equilibrium, $P_t^K = E_t\left[P_{t+1}^K\right]$, so in equilibrium $J \equiv (1-\delta)/(1+r)$.

By solving the first-order condition of the Bellman equation (10), we find:

$$\alpha_i \left(1-\eta_i\right) Y_{i,t} / K_{i,t} = \left(1+\tau_{i,t}\right) J \quad (13)$$

The equation means that the marginal output of capital is equal to the marginal cost of capital. Combining equation (2) and $Y_{i,t} = P_{i,t}Q_{i,t}$can be concluded that:

$$P_{i,t} = \left[\frac{\psi K_{i,t} \left(1+\tau_{i,t}\right) J}{\alpha_i \left(1-\eta_i\right)} \right]^{\frac{\eta_i}{\eta_i - 1}} \quad (14)$$

From equation (14), it can be seen that differences in financing costs will lead to an increase in product prices.

Due to lower operational risks, higher market positions, and more collateral assets of non-real estate public companies compared to real estate companies, which have higher operational risks and relatively fewer collateral assets, non-real estate public companies have significant advantages in financing. Let the additional financing cost of real estate companies be $\tau_{i,t}^e$,and the financing cost of non-real estate public companies be $\tau_{i,t}^N$,then it is inevitable that $\tau_{i,t}^e > \tau_{i,t}^N$.

Due to barriers to entry and exit, both real estate companies and non-real estate public companies satisfy the equilibrium condition in the market, and the marginal output of capital in the real estate sector is higher than that in non-real estate public companies. Assuming an exogenous information shock leads to higher expected returns in the real estate market, non-real estate public companies investing in the real estate industry through equity investment will inevitably increase borrowing from the financial system. On one hand, this crowds out external borrowing for real estate companies, increasing the difficulty of financing for real estate companies and raising the additional financing cost $\tau_{i,t}^e$.On the other hand, funds flowing from non-real estate public companies into real estate companies extend the financing chain, requiring higher investment returns and raising the additional financing cost of real estate companies.

The so-called bubble is the deviation of asset prices from the intrinsic value of the assets. For housing prices, the fundamental value of real estate determined by the market economy, and the deviation of market prices from this fundamental value, constitutes a bubble. Assuming the market price of real estate is P_t, the fundamental value of real estate is V_t, and the real estate bubble is B_t,then:

$$P_t = V_t + B_t \quad (15)$$

Exogenous information shocks do not affect the fundamental value of real estate V_t, so for real estate, the bubble is:

$$B_t = \left[\frac{\psi K_{i,t}\left(1+\tau^{e}_{i,t}\right)J}{\alpha_i\left(1-\eta_i\right)}\right]^{\frac{\eta_i}{\eta_i-1}} \quad (16)$$

From equation (15), it is clear that long-term equity investment in real estate by non-real estate public companies increases the additional financing cost $\tau^{e}_{i,t}$, for real estate companies, raising the real estate price bubble.

3.2 Measurement of Real Estate Bubbles

Meng & Rong analyzed the economic factors affecting the fundamental value of real estate through a dynamic general equilibrium model [15], mainly including land prices, interest rate levels, economic growth rates, inflation rates, exchange rates, and rent, etc. Let $Land_t$ represent land prices, R_t represent nominal interest rate levels, g_t represent economic growth rates, CPI_t represent the consumer price index, E_t represent nominal exchange rates, and $Rent_t$ represent housing rent, then:

$$V_t = \beta_0 + \beta_1 Land_t + \beta_2 R_t + \beta_3 g_t + \beta_4 CPI_t + \beta_5 E_t + \beta_6 Rent_t + e_t \quad (17)$$

Where $e_t \sim N(0, R)$ represents a random disturbance term, indicating other random factors affecting the fundamental value of real estate.

In behavioral finance, people's judgment of asset value is more based on the future returns brought by the asset [16]. When real estate serves as immovable property, its value is not only determined by the present value of future rental income but also the increase in market prices can enhance people's psychological value of real estate. Thus, people's expectations of changes in real estate prices are a significant reason for the deviation of market prices from the basic value of real estate [17]. Human living habits and thinking inertia mean that people's judgments on real estate prices are inevitably influenced by previous judgments, implying that the deviation between real estate prices and basic values has continuity over time, indicating that real estate bubbles will maintain inertia over time, influenced by the previous period. Therefore, we can assume the real estate bubble transfer process as:

$$B_t = \alpha * B_{t-1} + v_t \quad (18)$$

Where in $v_t \sim N(0, Q)$ is a random interference term, indicating other random factors that affect the real estate foam. There is no correlation between the random factors that affect the real estate foam and the random factors that affect its real value. Which is $E(e_t v_t') = 0$. From equations (14) and (16), it can be concluded that:

$$P_t = B_t + \beta_0 + \beta_1 Land_t + \beta_2 R_t + \beta_3 g_t + \beta_4 CPI_t + \beta_5 E_t + \beta_6 Rent_t + e_t \quad (19)$$

Since the real estate foam is a variable of uncertain state, the state space model can be used to estimate the time series data of the real estate foam.

Let $\Phi = [\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6]$, $Z_t = [1, Land_t, R_t, g_t, CPI_t, E_t, Rent_t]'$, then the state space model that the real estate market price meets is:

Measurement equation:

$$P_t = B_t + \Phi Z_t + e_t \quad (20)$$

Transition equation:

$$B_t = \alpha * B_{t-1} + v_t \quad (21)$$

Where $e_t \sim N(0, R)$, $v_t \sim N(0, Q)$, $E(e_t v_t') = 0$.

4. Data Processing and Research Design

This study examines the long-term equity investment of NFRE listed companies in the real estate industry and its impact on housing bubbles. The data for long-term equity investment by NFRE listed companies in the real estate industry requires financial reports from listed companies, including balance sheets, income statements, and notes to the financial statements. Research on housing bubbles requires constructing based on macroeconomic data, with data sources being the official website of the National Bureau of Statistics, Wind China Financial Database, and the CSMAR research database series by Guotai'an.

To obtain the total amount of long-term equity investment by listed companies in the real estate industry, the data processing procedure for the financial reports of listed companies is as follows: First, exclude ST and PT listed

companies, classify listed companies according to their industries into financial industry listed companies, real estate industry listed companies, and non-financial non-real estate industry listed companies, and delete listed companies in the real estate industry; Second, For the remaining listed company samples, mine data from the notes to the financial statements on long-term equity investments, classify according to the industries of the invested companies, and filter out invested companies in the real estate industry; Third, Sum up the long-term equity investments in real estate companies by listed companies annually, obtaining the annual total amount of long-term equity investment by listed companies in the real estate industry; Finally, To construct quarterly data of long-term equity investment by listed companies in the real estate industry, smooth the long-term equity investment data at the beginning and end of the year, take the average of the data at the beginning and end of the year to obtain the mid-year long-term equity investment data, and take the average of the mid-year data with the data at the beginning and end of the year to obtain the second and third quarter's long-term equity investment data.

This paper builds the foam data of real estate price based on the state space model. Referring to the research of Meng & Rong [15], we select the housing price, housing rent, land price, interest rate, consumer price index, nominal exchange rate and GDP to build the foam data of real estate price: ① The housing price structure selects the monthly cumulative sales of commercial residential buildings and the monthly cumulative sales area of commercial residential buildings, and the data are from the official website of the National Bureau of Statistics. Due to the missing data for one month, use smoothing method to fill in the data for one month and obtain the current value for each month. Sum up to obtain the quarterly sales revenue and sales area of commercial housing. Divide the sales revenue of commercial housing by the sales area to obtain the price of commercial housing, The construction of land prices selects the monthly cumulative transaction price of real estate industry land and the cumulative purchase area of real estate industry land. Due to the lack of monthly data, the smoothing method is used to supplement the monthly data and obtain the current value of each month. The quarterly real estate industry land transaction price and land purchase area are obtained by summing up the data. The quarterly data of land price is obtained by dividing the land transaction price by the land purchase area. The monthly price index and housing rent are selected as month on month data, and the housing rent is selected as a proxy variable using the housing consumption price index in CPI. The monthly month on month price index is multiplied to obtain the quarterly consumption price index based on the first quarter of 2007, which is used to measure the consumption price index and housing rent respectively GDP: Select the quarterly cumulative GDP value published on the website of the National Bureau of Statistics, calculate the quarterly current value, use X-12 seasonal adjustment to eliminate the influence of seasonal trends, and then take the logarithm; ⑤ The interest rate is chosen as the one-year fixed deposit interest rate, and the exchange rate is chosen as the nominal exchange rate between RMB and USD on the last day of each quarter.

5. Empirical Analysis and Robustness Test

5.1 State-space Model Coefficient Estimation

The estimation of the model relies on the full use of information; therefore, before estimating the model, the time and information variables are defined as shown in Table 1.

Table 1. State-Space Model Variables and Economic Meaning

Variables	Economic Meaning
I_t	Time t moment's information set
$B_{t\|t-1} = E(B_t\|I_{t-1})$	Real estate bubble follows a Markov process, the predicted real estate bubble value based on information at moment t-1
$S_{t\|t-1} = E[(B_t - B_{t\|t-1})(B_t - B_{t\|t-1})']$	Predicted variance of real estate bubble value based on information at moment t-1
$S_{t\|t} = E[(B_t - B_{t\|t})(B_t - B_{t\|t})']$	Predicted variance of real estate bubble value based on information at moment t
$S_{t\|t-1} = E(P_t\|I_{t-1})$	Predicted real estate market price based on information at

	moment t-1
$\eta_{t\|t-1} = P_t - P_{t\|t-1}$	Prediction error of real estate market price
$f_{t\|t-1} = E[\eta^2{}_{t\|t-1}]$	Variance of real estate market price prediction error
$B_{t\|T} = E(B_t\|I_T)$	Real estate bubble at moment t based on all moment's information
$S_{t\|T} = E[(B_t - B_{t\|T})(B_t - B_{t\|T})']$	Predicted variance of real estate bubble at moment t based on all moment's information

Since the real estate bubble is an uncertain time series data, it cannot be estimated using OLS or GMM. Based on the analysis above, we can obtain the likelihood function of the state-space model, hence, the model parameters can be estimated using Maximum Likelihood Estimation (MLE). This paper uses Matlab software and the Maximum Likelihood Estimation method to estimate parameters, and the results are as shown in Table 2:

Table 2. Coefficients Estimated from the State-space Model

Parameters	α	β_0	β_1	β_2	β_3	β_4	β_5	β_6	R	q
Estimated values	2.159	-3.574	-0.01	-0.496	-0.0270	0.763	0.068	0.576	1.015e-33	1.036

5.2 The Impact of Real Estate Equity Investment on Housing Price Bubbles

Using the state-space model estimated quarterly data of housing price bubbles and the total amount data of NFRE listed companies' real estate investments for regression analysis, the results are shown in Table 3. Firstly, it is necessary to determine the lag order of the dependent variable. By substituting lagged dependent variables of 0-3 periods into the regression, the regression results showed through AIC and BIC that the optimal lag order is 0 periods, and the regression results are seen in column 2 of Table 2. The regression results in column 2 of Table 2 indicate that the regression coefficient of the proportion of NFRE listed companies' real estate equity investment on housing price bubbles is significantly positive, suggesting that NFRE listed companies' investment in the real estate industry significantly increases the real estate price bubbles. From the regression results of control variables, it can be observed that the male ratio and rural household disposable income have no significant impact on real estate bubbles, indicating that the generally low income of rural families in China primarily constitutes the demand for housing as a necessity, and the high sensitivity to prices results in an insignificant impact on housing price bubbles. The proportions of minors, adults, and urban population have a significantly positive impact on real estate bubbles, suggesting that the population structure leading to rigid housing demand enlarges the real estate bubbles. Urban household disposable income has a significantly negative impact on housing price bubbles, indicating the unequal wealth distribution in China leads to a large wealth gap, and the general working class's demand for housing is primarily necessity-based, with low speculative buying demand. An increase in urban household disposable income makes people's consumption more rational, thereby effectively suppressing real estate speculation and reducing real estate bubbles.

Table 3. Estimated Results of the Quarterly Impact of Total Real Estate Investment of NFRE Listed Companies on House Price foam

	Lag 0 period	Lag 1 period	Lag 2 period	Lag 3 period
	Housing Price Bubble (B_t)			
Equity Investment Proportion ($NSIP_t$)	7.411***	7.930***	9.390***	10.639***
	(2.754)	(2.955)	(3.452)	(3.919)
Male Ratio ($Male_t$)	-13.617	-25.184	-31.224*	-38.603**
	(-1.002)	(-1.625)	(-1.924)	(-2.351)
Minor Population Ratio ($Children_t$)	16.796***	17.893**	17.199**	19.547***
	(2.659)	(2.460)	(2.461)	(2.884)
Minor population ratio ($Adult_t$)	14.195**	14.565**	13.652**	15.486***
	(2.564)	(2.304)	(2.233)	(2.625)
Urban household disposable income	-0.631**	-0.714**	-0.900***	-1.032***

($Income\_T_t$)	(-2.025)	(-2.229)	(-2.776)	(-3.140)
Rural household disposable income ($Income\_C_t$)	-0.030	-0.022	-0.044	-0.027
	(-0.526)	(-0.387)	(-0.787)	(-0.501)
Urban population ratio ($Town_t$)	6.248***	6.478***	6.810***	7.634***
	(3.077)	(2.842)	(3.039)	(3.484)
Housing price bubble with a one-period lag (B_{t-1})	0	-0.221	-0.332*	-0.385*
	0	(-1.115)	(-1.679)	(-1.919)
Housing price bubble with a two-period lag (B_{t-2})	0	0	0.101	0.077
	0	0	(0.591)	(0.470)
Housing price bubble with a three-period lag (B_{t-3})	0	0	0	-0.314**
	0	0	0	(-2.161)
Constant term	-7.097	-1.452	3.031	5.087
	(-0.915)	(-0.169)	(0.328)	(0.559)
Number of observations	40	39	38	37
Adjust goodness-of-fit	0.386	0.394	0.446	0.509
AIC	-189.4378	-184.6434	-182.3697	-180.2557
BIC	-175.9268	-169.6714	-165.9938	-162.5356

note: *** p<0.01, ** p<0.05, * p<0.1

5.3 Further Discussion

To test the impact mechanism of real estate equity investment on real estate price bubbles, this paper estimates the crowding out of loan funds in real estate development investment by real estate equity investments. Firstly, at the microenterprise level, it is estimated that real estate equity investments increase the borrowing of NFRE listed companies from the banking system. This type of over-financing from the banking system, at the aggregate level, would crowd out the sources of loan funds in real estate development investment. Therefore, the model for examining the impact of real estate equity investments on the over-financing of NFRE listed companies at the micro level is as follows:

$$\mathrm{EFR}_{i,t} = \beta_0 + \beta_1 ESI_{\mathrm{i,t}} + \beta_2 \mathrm{Risk}_{i,t} + \beta_3 \mathrm{Ln}Asset_{i,t} + \beta_3 \mathrm{Ln}Age_{i,t} + \beta_4 \mathrm{ROA}_{i,t} + \beta_5 \mathrm{Ln}Revenue_{i,t} + \beta_6 \mathrm{Leverage}_{i,t} + \beta_7 \mathrm{d}_{\mathrm{pro}} + \beta_8 \mathrm{d}_{\mathrm{ind}} + \beta_9 \mathrm{d}_{\mathrm{state}} + u_i + u_{i,t} \quad (21)$$

Empirical testing was conducted on the impact of real estate equity investment on excessive financing through the ratio of excessive financing. The estimated results are shown in the Table 4:

Table 4. Estimated Results of the Impact of Real Estate Equity Investment on Over-Financing

	Random Effects (RE)	Fixed Effects (FE)	System Generalized Method of Moments (SGMM)
	Over-financing Rate ($\mathrm{EFR}_{i,t}$)	Over-financing Rate ($\mathrm{EFR}_{i,t}$)	Over-financing Rate ($\mathrm{EFR}_{i,t}$)
Real estate equity investment rate ($ESI_{\mathrm{i,t}}$)	4.401***	2.634***	2.964*
	(6.626)	(3.649)	(1.724)
Business risks ($\mathrm{Risk}_{i,t}$)	-1.005***	-0.662***	-1.069
	(-3.997)	(-2.784)	(-1.270)
Total asset logarithms ($\mathrm{Ln}Asset_{i,t}$)	21.389***	23.424***	14.085***
	(8.487)	(3.121)	(3.175)
The logarithm of the age of the enterprise ($\mathrm{Ln}Age_{i,t}$)	6.402	9.918	3.755
	(1.068)	(0.660)	(0.821)
Net profit margin on corporate assets ($\mathrm{ROA}_{i,t}$)	38.880	43.476	31.342
	(0.856)	(0.681)	(0.942)
Logarithm of operating income ($\mathrm{Ln}Revenue_{i,t}$)	-18.195***	-23.958***	-12.348***
	(-7.806)	(-4.773)	(-3.041)
Corporate leverage ($\mathrm{Leverage}_{i,t}$)	51.459***	64.509**	32.328***
	(4.039)	(2.337)	(3.079)

Whether it is a state-owned enterprise	3.335	0	1.166
	(0.853)	0	(0.269)
The over-financing rate lags by one period ($EFR_{i,t-1}$)	0	0	0.410***
	0	0	(4.272)
province	control	control	control
industry	control	control	control
Constant terms	-143.035***	-62.142	-84.351**
	(-3.956)	(-0.652)	(-2.356)
Number of observations	758	758	758
F	0	9.717	19.037
	0	0	[0.000]
AR (1)	0	0	-2.59
	0	0	(0.000)
AR (2)	0	0	-0.78
	0	0	(0.433)
Hansen	0	0	27.01
	0	0	(0.409)

Using a fixed effects model, it can be seen from the results of fixed effects estimation that an increase in real estate equity investment rate can increase NFRE listed companies' excessive financing from the banking system. However, considering that long-term borrowing by listed companies generally exceeds one year, there is a temporal continuity in bank borrowing, and it is necessary to add a lagged term of the dependent variable. Considering the endogeneity of the lagged term of the dependent variable, this paper uses System Generalized Moment Estimation (SGMM) to solve the problems of lag and endogeneity.

From the above analysis, it can be seen that an increase in real estate equity investment by NFRE listed companies will lead to excessive financing from the banking system. However, whether this excessive financing will squeeze the source of loan funds for real estate investment needs to be tested at the overall level. The AR model is used for regression analysis, and the estimated results are shown in Table 5. From the Table 5, it can be seen that an increase in real estate equity investment by NFRE listed companies will lead to an increase in real estate equity investment from the banking system, thereby squeezing out the domestic loan funds in real estate investment and reducing the proportion of domestic loan funds for real estate investment development in China.

Table 5. Impact of the Total Amount of Real Estate Equity Investment by NFRE Listed Companies on the Proportion of Real Estate Loan Investment

	Loan crowding out			
	Proportion of loans for real estate investment in China	Proportion of loans for real estate investment in China	Proportion of loans for real estate investment in China	Proportion of loans for real estate investment in China
The total amount of overfinancing by NFRE listed companies	0.725*** (13.656)	-0.050*** (-3.335)	0	0
Total real estate equity investments in NFRE listed companies	0	0	-0.719 (-0.109)	-2.245*** (-2.844)
Constant terms	-5.579*** (-8.360)	0.770*** (4.078)	3.537*** (71.829)	0.154*** (26.004)
Number of observations	40	40	40	40
Adjust goodness-of-fit	0.826	0.206	-0.026	0.154
F	186.479 [0.000]	11.123 [0.000]	0.012 [0.000]	8.087 [0.000]

Combining equation (15), it can be observed that NFRE listed companies' long-term equity investments in real estate, by increasing the quantity of loans in the banking system, crowd out domestic loan funds for real estate development investment, thereby raising additional financing costs for real estate companies$\tau_{i,t}^{e}$,and increasing the real estate price bubble.

6. Conclusion

This study investigates the impact of non-financial and non real estate companies' long-term equity investment in the real estate sector on the real estate price foam. Firstly, this paper theoretically analyzes the impact mechanism of long-term equity investment of NFRE listed companies on real estate price foam, and uses the state space model to quantify these foam. Then, using macroeconomic data within the framework of the national spatial model, we estimated the quarterly data of China's real estate price foam from 2016 to 2023, and used NFRE listed companies to conduct regression analysis on the total long-term equity investment in real estate. Finally, this paper discusses the impact mechanism of long-term equity investment on the real estate foam from the micro and macro perspectives. The study found that there has been a foam in China's real estate prices in the past decade, and a large amount of capital inflows and outflows will have a certain impact on the normal and stable operation of the economy. The foam level was high from 2015 to 2018. The long-term equity investment of NFRE listed companies in the real estate field tends to push up the level of the foam of real estate prices. This is mainly because such investment has increased the excessive financing of enterprises from the banking system. On the one hand, it has squeezed out the loan funds for real estate investment and development, and on the other hand, it has increased the capital cost of real estate development, thus exacerbating the foam of real estate prices.

The research indicates that investments in the real estate industry by non-financial and non-real estate enterprises are a significant cause of the current real estate price bubbles in China. Real estate, as a consumer good, creates value for the physical economy, and the real estate industry has the nature of the physical economy. However, as an investable immovable asset, real estate also plays a role in value preservation and appreciation, exhibiting characteristics of the virtual economy. The influx of capital from non-real estate enterprises into the real estate industry, on one hand, increases real estate price bubbles, leading to excessive prosperity in the real estate industry, overdevelopment, and excessively high inventory. It also results in an increasing wealth gap between property owners and non-owners, particularly in major cities where high property prices severely damage worker motivation, which is detrimental to social stability and economic development. On the other hand, the large inflow of capital into the real estate sector squeezes investment in productive enterprises, leading to difficulties and high costs of financing for productive enterprises, thus causing a contraction in investment in the physical economy. The Chinese government needs to perfect the financial regulatory mechanism, restrict equity investments in the real estate sector by non-financial and non-real estate enterprises, and strengthen the management of social investment structure. Through preferential interest rates, industrial subsidies, and other policies, the government should guide capital towards sectors of the productive economy, thereby curbing the massive inflow of social capital into the real estate sector, reducing real estate price bubbles, promoting the development of the productive physical economy, and achieving industrial structure adjustment and economic upgrading and transformation.

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