

Two-Way Fixed Effects Estimation on the Impact of rising house prices on the capital structure of real enterprises in China

Jianlin He

Yunnan University of Finance and Economics, Yunnan, 650221, China

Abstract. Since the implementation of China's reform and opening-up policy, rapid economic growth has led to the rapid development of the real estate market and housing prices have entered the fast lane of growth. As housing prices rise, the allocation of credit funds in China will continue to be tilted towards the real estate sector. This has a "crowding out" effect on the real economy and is not conducive to the positive optimisation of corporate capital structure. Little research exists on the lagged nature of house price inflation and its impact on the capital structure of real enterprises. To fill this gap, this paper investigates the lagged effect of house price changes on the adjustment of capital structure of real enterprises and the heterogeneity between regions based on a two-way fixed effects model with a sample of 30 Chinese provinces over the period 2000-2020. The study finds that in the short run, rising house prices do not have a significant impact on the capital structure of real enterprises. In the long run, enterprises' debt levels rise and their capital structure adjusts negatively. There is a lag in the central and western regions and no lag in the eastern regions. After a series of robustness tests, the results remain significant and robust. This study provides a reference for the government to establish a long-term mechanism for the stable development of the real estate market.

Keywords: Rising house prices; Capital structure of real enterprises; Two-way fixed effects model.

1. Introduction

Since the implementation of China's reform and opening-up policy, the country's rapid economic growth has led to a boom in the real estate market. Along with the rapid development of the real estate sector, housing prices have also entered the fast lane of growth, with the average sales price of commercial properties nationwide doubling by 4.67 times between 2000 and 2020. However, experience has proven that overheated housing prices can lead to the emergence of a bubble economy. With the bursting of the real estate bubble, the risk will shift from the real estate sector to the financial sector, creating a financial crisis.

Theoretically, the impact of rising house prices on the real economy is twofold. On the one hand, the rise in property prices, as collateral, helps to ease the credit constraints of enterprises, allowing financial institutions to provide more funds to other sectors of the economy and promote real business investment [1]. This is the "liquidity effect" or the "collateral effect". On the other hand, as house prices rise, the expected rate of return on holding and investing in real estate will continue to rise, and enterprises will obtain credit at lower costs and invest heavily in the real estate sector, creating a "crowding out effect" on investment in the real economy [2].

Most of the existing literature considers the impact of house prices on corporate investment and corporate profits, but less research has been conducted on the adjustment of capital structure. In addition, there is still a gap in the analysis of the time effect and regional heterogeneity of house price changes on capital structure adjustment. Based on this, this paper will consider the impact of the "collateral effect" and "crowding out effect" caused by rising house prices on the adjustment of corporate capital structure and analyse the heterogeneity between regions, and make corresponding comments accordingly.

2. Literature Review and Hypothesis

Since China's reform and opening up, the government has intervened in the allocation of financial resources through a policy of financial disincentives, which has led to significant industrial and infrastructure development [3]. At this time, 'Political Pecking Order' left the non-state sector facing severe financing constraints [4]. However, Caballero et al. [5] found that asset bubbles were effective in mitigating the effects of financial repression policies and increasing investment in the national economy. Luo Shikong and Zhou Yahong [6] also used a sample of Chinese listed enterprises and the results of their empirical analysis showed that when the degree of corporate financing constraints is high, rising house prices significantly boost corporate investment. This is "collateral effect". Rampini and Viswanathan [7] found that the "collateral effect" brought about by rising house prices can ease the credit constraints of enterprises and further facilitate positive recapitalisation.

However, as property prices rise, China's credit allocation will continue to be skewed towards the real estate sector, creating a 'crowding out' effect on the real economy. According to the National Bureau of Statistics of China, between 2000 and 2020, real estate investment rose from 15.14% to 26.83% of fixed asset investment, a 28.38-fold increase in real estate investment. Using data from US listed companies, Chaney et al. [8] found that an increase in the value of real estate increases corporate investment and increases the size of corporate debt.

Farhi and Tirole [9] find, by introducing a credit constraint condition, that a certain level of real estate bubble is conducive to relaxing credit constraints on enterprises, helping efficient projects to obtain financing and promoting real economic growth; however, when the real estate bubble becomes large enough, it can lead to a flow of capital from the real sector to the already over-exuberant real estate market, which is detrimental to the development of the real economy. Fougère [10] argues that real estate as collateral is also an input in the production of a product and that an increase in the price of real estate will reduce the expected return by increasing the rent or the cost of purchasing the property.

In summary, this paper argues that there is a "collateral effect" of rising house prices in the short term, which is beneficial to corporate development and capital restructuring. However, in the long run, the driving effect of rising house prices on the real economy will gradually turn into a crowding-out effect, and capital restructuring will change accordingly. For this reason, this paper proposes hypothesis 1:

Hypothesis 1: As house prices continue to rise, the recapitalisation of real companies is unaffected or tends to adjust positively in the short term, but in the long term there is a negative adjustment with a rise in the level of over-indebtedness.

In addition, according to Xu Ye and Yu Jiaju [11], the mechanism by which rising house prices affect the debt levels of SOEs and non-SOEs is different, with rising house prices more likely to increase the level of over-indebtedness of non-SOEs. Given the heterogeneous distribution of SOEs in China and the different economic development paths and policy orientations across the country, this paper therefore proposes hypothesis 2.

Hypothesis 2: The impact of rising house prices and the capital structure of real enterprises is heterogeneous across regions.

3. Methodology

3.1 Data

The data in this paper are mainly obtained from China Statistical Yearbook, China Environmental Statistical Yearbook and China Science and Technology Statistical Yearbook. This paper uses 30 provinces (excluding Tibet, Hong Kong, Macao, and Taiwan) in China from 2000 to 2020 as the research sample to explore the impact of rising house prices on the capital structure of real enterprises.

3.2 Variable

The dependent variable in this paper is the capital structure of real enterprises. Drawing on the research of Wang Chaoyang et al [12], this paper uses the gearing ratio, i.e. total liabilities/total assets, of industrial enterprises above the designated size in China as a measure.

The core explanatory variable is the degree of house price inflation, specifically, average sales price of commercial housing in the current year/average sales price of commercial housing in the previous year.

In addition, this paper also selected other variables that may affect the dependent variables and explanatory variables as control variables: environmental regulation (investment in industrial pollution control as a share of GDP by region); imports and exports (total imports and exports as a share of GDP by region); infrastructure (road density by region, i.e. the ratio of road miles to population); technological innovation (number of patent applications received by region); industrial structure (tertiary sector as a share of GDP).

Considering the possible measurement problems such as non-linear relationship and non-stationary series in the panel data of each variable, as well as the need to maintain consistency in calibre and magnitude, the empirical analysis of each variable is conducted in logarithmic form in this paper.

Table1. Descriptive statistics of variables.

Variable	Obs	Mean	Std	Min	Max
LEV	630	58.85	5.460	36.69	76.08
HPG	630	109.3	8.640	84.68	156.7
ER	630	0.160	0.140	0.001	0.990
IE	630	30.06	36.86	0.760	172.2
HD	630	30.58	21.85	2.690	143.6
TI	630	56194	109816	124	967204
IS	630	42.96	9.280	28.60	83.90

3.3 Statistical Model

Most of the existing studies mainly consider the individual effects of the panel data and do not adjust for residual correlations across time and regions, which can lead to large errors in the results. This paper takes this factor into account and chooses to use a two-way fixed effects model that considers both individual and time effects to analyse the impact of house price changes on the recapitalisation of real enterprises and the lagged effects.

$$LEV_{it} = \beta_0 + \beta_1 HPG_{it} + \beta_2 X + \mu_i + \varphi_i + \varepsilon_{it} \quad (1)$$

The subscripts i and t index the province and the year, respectively. LEV indicates capital structure of real enterprises. HPG denotes the degree of house price inflation. X is the control variable. μ_i is the province fixed effect that does not change with time, φ_i refers to the time fixed effect, which reflects the influence of the omitted variables that change with time but not with provinces on the dependent variables. ε_{it} denotes random noise terms. β_0 is a constant term. β_1 and β_2 are the coefficients of core explanatory variable and control variables.

The results of the Hausman test showed a p-value of 0.000, so the original hypothesis was rejected, i.e. a fixed-effects model should be used instead of a random-effects model.

4. Results

4.1 Benchmark Regression Results

According to the results in the table2, the impact of house price changes on the capital structure of real estate enterprises in the current period is insignificant with a coefficient of -0.045; house price changes do not affect the capital structure of real estate enterprises until a lag of three years and are

statistically significant at the 1% level. This strongly supports hypothesis 1. In the short run, real estate enterprises have access to more credit due to its collateralising properties, which can be used to invest and optimise their capital structure, which is reflected in the 'collateral effect'. In the long run, as property prices continue to rise, enterprises will invest a large amount of their credit facilities in the real estate sector, creating a "crowding out effect" on investment in the real economy, resulting in rising debt levels and negative capital structure adjustments.

Considering the possible two-way causal relationship between house price changes and the recapitalisation of real enterprises, in order to address this endogeneity issue, a one-period lag of house price changes across locations was selected as the instrumental variable for two-stage least squares estimation. The regression results are consistent with expectations and the findings from the empirical analysis remain robust.

Table 2. Benchmark regression results

	LEV(1)	LEV(2)	LEV(3)	LEV(4)
HPG	-0.045 (-1.28)			
L1.HPG		0.028 (0.82)		
L2.HPG			0.055 (1.63)	
L3.HPG				0.085*** (2.53)
ER	0.002 (0.57)	0.0008 (0.18)	-0.0002 (-0.05)	-0.002 (-0.44)
IE	-0.040*** (-4.89)	-0.039*** (-4.66)	-0.038*** (-4.51)	-0.36*** (-4.24)
HD	-0.043*** (-3.23)	-0.046*** (-3.30)	-0.048*** (-3.19)	-0.045*** (-2.80)
TI	-0.003 (-0.44)	-0.003 (-0.40)	-0.003 (-0.33)	-0.003 (-0.35)
IS	0.176*** (5.09)	0.172*** (4.89)	0.171*** (4.80)	0.164*** (4.53)
Province fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Constant	3.944*** (17.65)	3.591*** (16.08)	3.461*** (15.38)	3.345*** (14.84)
Obs	630	600	570	540
R-squared	0.2358	0.194	0.187	0.179

Note: values in parentheses are t-values; *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

4.2 Analysis of regression results by region

The paper divides the 30 provinces of China into eastern, central and western regions according to their location. The regression results are shown in the table3: the effect of rising house prices on the recapitalisation of real enterprises in the central and western regions is not significant in the current period and with a lag of one to two, and has a negative coefficient in the current period. However, the opposite trend is observed in the eastern region. This strongly supports hypothesis 2. The reason for this is that eastern China has a higher level of economic development than central and western China, and its real estate market is close to saturation, so as house prices rise year on year, more real estate enterprises choose to invest in the central and western real estate markets in order to make higher profits. In addition, given the uneven regional distribution of Chinese state-owned enterprises, most of which are concentrated in the eastern region, the rise in house prices has led to an adjustment in the capital structure of the eastern entities in the current period, i.e. a reduction in real estate investment and a positive adjustment in capital structure.

Table 3. regression results by region

	Central and Western regions				Eastern regions			
	LEV(1)	LEV(2)	LEV(3)	LEV(4)	LEV(1)	LEV(2)	LEV(3)	LEV(4)
HPG	-0.006 (-0.14)				-0.129** (-2.14)			
L1.HPG		0.045 (1.01)				-0.033 (-0.56)		
L2.HPG			0.064 (1.45)				-0.007 (-0.13)	
L3.HPG				0.086** (1.98)				0.027 (0.46)
ER	0.005 (0.93)	0.005 (0.83)	0.005 (0.80)	0.004 (0.73)	-0.007 (-1.06)	-0.009 (-1.38)	-0.012* (-1.71)	-0.016** (-2.32)
IE	-0.055*** (-6.40)	-0.054*** (-6.10)	-0.052*** (-5.79)	-0.050*** (-5.59)	0.023 (0.78)	0.029 (0.97)	0.026 (0.84)	0.041 (1.29)
HD	-0.138*** (-6.68)	-0.128*** (-5.86)	-0.123*** (-5.26)	-0.120*** (-4.82)	-0.012 (-0.50)	-0.025 (-1.00)	-0.034 (-1.28)	-0.043 (-1.48)
TI	0.003 (0.27)	0.002 (0.18)	0.001 (0.13)	-0.002*** (-0.16)	-0.013 (-0.95)	-0.018 (-1.27)	-0.022 (-1.57)	-0.021 (-1.40)
IS	0.236*** (5.84)	0.224*** (5.30)	0.213*** (4.94)	0.191*** (4.34)	0.037 (0.48)	0.040 (0.51)	0.067 (0.86)	0.085 (1.07)
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.806*** (14.09)	3.575*** (13.07)	3.512*** (12.58)	3.513*** (12.49)	4.578*** (11.63)	4.130*** (10.32)	3.971*** (9.78)	3.700*** (8.85)
Obs	399	380	361	342	231	220	209	198
R ²	0.387	0.336	0.316	0.299	0.178	0.128	0.140	0.163

Note: values in parentheses are t-values; *, ** and *** denote statistical significance at the 10% , 5% and 1% levels, respectively.

4.3 Robustness tests

This paper controls for year fixed effects and province fixed effects by building a two-way fixed effects model, and sets up five control variables to control for possible endogeneity problems arising from omitted variables; at the same time, it solves part of the endogeneity problems arising from two-way causality through the instrumental variables approach. To further enhance the robustness of the empirical findings of this paper and to mitigate the endogeneity problem arising from the possible measurement error problem, this paper continues to use two methods, namely replacing core explanatory variables and replacing samples, to conduct robustness tests in order to reduce the sample measurement error.

As shown in the table4, this paper chooses to replace the core explanatory variable with the growth rate of house prices. It can be found that the growth rate of house prices can explain the corporate gearing at a statistical level of 5% with a lag of three years. In addition, this paper further does the regression by excluding the samples from four municipalities directly under the Central Government of Beijing, Shanghai, Tianjin and Chongqing. It is found that in the short run, the increase in house prices does not affect the gearing ratio, which is basically in line with the hypothesis. It can thus be concluded that both tests hold and the stability of this paper is further enhanced.

Table 4. Robustness tests results

	Change of independent variable				Change of sample			
	LEV(1)	LEV(2)	LEV(3)	LEV(4)	LEV(1)	LEV(2)	LEV(3)	LEV(4)
HPG	-0.0004 (-1.28)				0.024 (0.64)			
L1.HPG		0.0003 (0.82)				0.075** (2.04)		
L2.HPG			0.0005 (1.62)				0.090** (2.48)	
L3.HPG				0.0008** (2.48)				0.105*** (2.91)
ER	0.003 (0.58)	0.0008 (0.18)	-0.0003 (-0.06)	-0.002 (-0.45)	0.003 (0.56)	0.002 (0.39)	0.002 (0.43)	0.001 (0.28)
IE	-0.040*** (-4.88)	-0.039*** (-4.66)	-0.038*** (-4.52)	-0.036*** (-4.26)	-0.054*** (-6.42)	-0.053*** (-6.12)	-0.052*** (-5.89)	-0.049*** (-5.52)
HD	-0.043*** (-3.23)	-0.046*** (-3.29)	-0.048*** (-3.19)	-0.045*** (-2.79)	-0.070*** (-4.59)	-0.071*** (-4.30)	-0.070*** (-3.97)	-0.058*** (-3.06)
TI	-0.003 (-0.44)	-0.003 (-0.40)	-0.003 (-0.33)	-0.003 (-0.34)	-0.007 (-0.94)	-0.009 (-1.17)	-0.010 (-1.27)	-0.014* (-1.67)
IS	0.177*** (5.10)	0.172*** (4.89)	0.171*** (4.80)	0.164*** (4.51)	0.211*** (6.05)	0.193*** (5.41)	0.181*** (5.00)	0.162*** (4.35)
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.738*** (25.26)	3.720*** (24.16)	3.714*** (23.50)	3.739*** (22.99)	3.650*** (15.73)	3.463*** (15.01)	3.437*** (14.86)	3.443*** (14.74)
Obs	630	600	570	540	546	520	494	468
R ²	0.236	0.194	0.187	0.179	0.305	0.263	0.250	0.228

Note: values in parentheses are t-values; *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

5. Conclusions

This paper explores the impact of rising house prices on the capital structure of real enterprises based on relevant data from 30 Chinese provinces (municipalities and autonomous regions) from 2000 to 2020. The study finds that in the short run, rising house prices do not have a significant impact on the capital structure of real enterprises. In the long run, enterprises' debt levels rise and their capital structure adjusts negatively. In addition, there is regional heterogeneity in the impact of house price changes.

Based on the above problems, corresponding policy recommendations are put forward: firstly, local governments should improve the access mechanism for the real estate industry and restrict real estate speculation; secondly, the government should correct the non-market allocation of credit resources at the national level and ensure that state-owned enterprises and private enterprises have a fair market position in accessing credit funds, while enriching financing guarantee channels to ease the credit constraints of non-state-owned enterprises; finally, government departments should also actively promote reforms in the land system, housing security system, financial and fiscal system and corporate information disclosure system to establish a long-term mechanism for the stable and healthy development of the real estate market.

Reference

- [1] Heitor Almeida, Murillo Campello, Financial Constraints, Asset Tangibility, and Corporate Investment, *The Review of Financial Studies*, Volume 20, Issue 5, September 2007.
- [2] LUO Zhi, ZHANG Chuanchuan. Credit Expansion, Real Estate Investment and the Efficiency of Resource Allocation in Industry. *Journal of Financial Research*, 2015, 42(7): 60-75.
- [3] YU Jingwen. Optimal Financial Condition and Economic Development: Empirical Evidence from Cross Country Data and Application in China. *Economic Research Journal*, 2013(12):106-119.
- [4] Huang Y, Ma Y, Yang Z, et al. A Fire Sale without Fire: An Explanation of Labor-intensive FDI in China[J]. *SSRN Electronic Journal*, 2008.
- [5] Caballero R J, Krishnamurthy A. Bubbles and Capital Flow Volatility: Causes and Risk Management[J]. *Journal of Monetary Economics*, 2006, 53.
- [6] LUO Shi-kong, ZHOU Ya-hong. Do Housing Prices Affect Corporate Investment? Theoretical and Empirical Analysis [J]. *Journal of Finance and Economics*, 2013, 39(08): 133-144.
- [7] ADRIANO A. RAMPINI, S. VISWANATHAN. Collateral and capital structure[J]. *Journal of financial economics*, 2013, 109(2):466-492.
- [8] Chaney T, Saraer D, Thesmar D. The Collateral Channel: How Real Estate Shocks Affect Corporate Investment[J]. *American Economic Review*, 2012, 102(6): 2381- 2409.
- [9] Farhi E, Tirole J. Bubbly Liquidity [J]. *The Review of Economic Studies*, 2012, 79(2): 678-706 .
- [10] Fougère, Lecat R, Ray S. Real Estate Prices and Corporate Investment: Theory and Evidence of Heterogeneous Effects Across enterprises[J]. *Social Science Electronic Publishing*. 2017.
- [11] XU Ye, YU Jia-ju. The Impact of China's Urban Housing Price on Corporate Over-Debt: From the Perspective of Corporate Heterogeneity. *Contemporary Finance & Economics*, 2018(07):112-122.
- [12] WANG Chao-yang, ZHANG Xue-lan, BAO Hui-na. Economic Policy Uncertainty, the Dynamic Adjustment of Enterprises' Capital Structure and Stabilizing Leverage. *China Industrial Economics*, 2018(12):134-151.