Investments of Listed Real Estate Firms in China

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Highlights

1. We estimated Tobin's marginal q and average q using yearly data for 116 listed real estate firms in China for the period 2002–2020.

2. The investments can be explained by q theory. Because q, and especially marginal q, includes housing bubble profits, there are likely to be overinvestments in these firms.

Abstract

We estimated Tobin's marginal q and average q from yearly data for 116 listed real estate firms in China for the period 2002–2020. The investments can be explained by q theory. Because q, and especially marginal q, includes housing bubble profits, there are likely to be overinvestments in these firms.

1 Introduction

1.1 Issues for real estate firms in China

In the third quarter of 2021, Evergrande, China's largest real estate group, experienced a debt crisis (outstanding debt of 300 billion United States (US) dollars; Qiu and Wan 2021a, Wan and Qiu 2023), followed closely by Shimao Property Holdings Limited, another large real estate company in China, in December 2021. China's real estate industry is burdened with huge debt totaling nearly 5 trillion US dollars (Wall Street Journal, Oct. 10, 2021). Consequently, China's real estate industry continues to experience serious debt issues. Coupled with the impact of the pandemic, social instability was exacerbated by a large number of employees in real estate-related sectors losing their jobs.

To explain why the above-described phenomena occurred in China, Wan (2021a) presented a demand driving theory in which a real estate firm supplies "bubble housing" to meet demand from the household side. This theory is empirically supported by industrial sector data from Wan and Qiu (2023). However, no consensus has been reached as to why a Chinese household would engage in a speculative housing purchase. However, Zhang et al. (2020) and Wen et al. (2014) argued that this is due to inequities in educational resources with respect to the household registration system.

Coincident with the debt issue of real estate firms is overinvestment in the asset side. Few studies have examined this issue although, according to Qiu and Wan (2021a), there are only 19 listed real estate firms that do not meet the three governmental standards for analysis.

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1.2 This work

Here, we will extend Qiu and Wan's (2021a) work to 116 listed real estate firms in China, and estimate Tobin's marginal q and average q through analysis of yearly firm-level data. We will attempt to obtain robust results comparable to those of Qiu and Wan (2021a) and determine whether the investments can be explained by q theory. If we can show that q, especially marginal q, is partly based on housing bubble profits, it can be assumed that there has been overinvestment in the listed real estate firms.

1.3 Structure of this paper

The remainder of this paper is organized as follows. The research question and hypotheses are presented in Section 2. Section 3 describes the data sources. The estimations of the depreciation rate, before- and after-tax marginal q, average q and investment equation, and empirical and regression results are summarized in Section 4. Section 5 concludes the work and suggests directions for future study.

2 Research question and hypotheses

According to Qiu and Wan (2021a), against the background of the serious real estate bubble in China, real estate firms may sell houses at bubble prices to obtain additional profits. Thus, both marginal q and average q may include housing bubble profits. Investors such as households seem to believe that the price of real estate will continuously increase in the future. Real estate firms often conduct pre-sales and future

trades, and/or postpone the sale of completed real estate, under real estate bubble conditions.

Hypothesis 1: The investment behaviors of the surveyed real estate firms follow Tobin's q theory, and q may include housing bubble profits (Tobin 1963, 1969, Wan 2021c, Wan and Qiu 2023).

3 Panel data on the 116 listed real estate firms in China

According to publicly available information from the National Bureau of Statistics of China, there are currently 207 listed real estate firms in China. However, these companies exhibit diverse business practices. Thus, it is necessary to ensure that each firm's income is mainly derived from the development or sale of real estate. Based on their mission statements, we only considered firms meeting the following three conditions as real estate entities:

1) main income (> 80%) derived from real estate development or property rental;

2) operating in the real estate industry at the end of 2020;

3) operating in the real estate industry for > 4 years without changing the core business.

The screening process revealed that only 134 of the 207 real estate firms met the above three criteria, 18 of which had significant missing data; thus, 116 firms were

included in the final analysis. Due to differences in accounting practices, the figures

disclosed on financial statements may differ among firms. Thus, we carefully read the

financial statements of all 116 firms. Missing data were replaced with each firm's own

average value for a given variable. We also extracted the annual average share price of

each firm from a website (https://cn.investing.com/equitie) to calculate the average q.

4 Empirical analysis

4.1 Inventory as a means of production

We assumed that the capital stock included the inventory, given that Chinese

households buy real estate not only for residential reasons, but also in the expectation

that housing may provide a good store of wealth and increase in value. In a speculative

market, households hope to buy houses as early as possible, while developers hope to

sell houses as late as possible. As such, the inventory of completed housing can lead to

housing bubble profits for a real estate firm. This inventory raises housing prices and

ultimately serves as special working capital or a means of production. Moreover, the

inventory could be a potential source of overinvestment.

4.2 Depreciation rate

We use the same method as Qiu and Wan (2021a, b) and Wan and Qiu (2022) to

derive empirical data:

$$\delta_{DEAI-it} = \frac{\Delta AD_{it}/PIIFA_t}{TVFAHI_{it-1}}, \tag{1}$$

$$\Delta AD_t = AD_{it} - AD_{it-1}, \tag{2}$$

$$TVFAHI_{it} = TVFA_{it} + Inventory_{it}, \tag{3}$$

$\delta_{DEAI-it}$: depreciation rate according to the "depreciation expense as an accounting item" (DEAI) for the inventory of real estate firm i at time t;

ΔAD_{it}: changes in the accumulated depreciation of i at t;

$PIIFA_t$: price index for investment in fixed assets at t;

$TVFAHI_{it}$: total value of fixed assets with the inventory of i at time t;

AD_{it}: accumulated depreciation of i at t;

$TVFA_{it}$: total value of fixed assets of i at t.

4.3 Estimation of marginal q and average q

The marginal q was estimated following Ogawa et al. (1994), Qiu and Wan (2021a, b), and Wan and Qiu (2023):

$$Mq_{it} = \frac{\pi_{it}}{P_{it}^I} \frac{1+r_i}{r_i + \delta_{DEAI-i}}, \tag{4}$$

Mq_{it}: before- and after-tax marginal q of real estate firm i at time t;

π_{it}: ratio of total profit before and after tax with the inventory of i at t;

P_{it}^I: investment of i at t;

δ_{DEAI-i}: average depreciation rate according to DEAI with the inventory of i during the study period;

r_i: average interest payments of industrial sectors of i during the study period.

Tobin's (1963, 1969) formula is applied to estimate the average q:

$$Aq_{it} = \frac{EMV_{it} + TD_{it}}{TA_{it}},$$ (5)

Aq_{it}: average q of real estate firm i at time t;

EMV_{it}: equity market value (average stock price per share × total number of shares) of i at t;

TD_{it}: total book value of debt of i at t;

TA_{it}: total book value of assets of i at t.

We used the marginal and average q values to test *Hypothesis 1*.

4.4 Specification of the investment

Empirically, we specified the investment based on Abel (1980), Chirinko (1993), Ogawa et al. (1994, 2019), and Wan and Qiu (2023):

$$\frac{I_{it}}{K_{it-1}} = \xi_0 + \xi_1 q_{it} + \xi_2 RHIFA_{it} + \mu_i + \gamma_t + \varepsilon_{mt},$$ (6)

$\frac{I_{it}}{K_{it-1}}$: *Investment* / $TVFAHI_{it-1}$ of real estate firm i at time t;

q_{it}: before-tax marginal q, after-tax marginal q, and average q of i at t;

$RHIFA_{it}$: $TVFAHI_{it}$ / $Total\ Assets_{it-1}$ of i at t. We suggest that $RHIFA$ may reflect the impact of the fixed asset sizes of different firms on the depreciation rate.

ξ_1 and ξ_2 are coefficients, and μ_i, γ_t, and ε_{mt} are firm-specific effects, time effects (yearly trends or dummy variables), and random errors, respectively.

We used the panel estimation method with fixed effects and robust standard errors to obtain the parameters and make inferences. Equation (6) was used to test *Hypothesis 1*.

4.5 Empirical results

4.5.1 Depreciation rate of 116 listed real estate firms

Figure 1 shows the average annual depreciation rate according to the DEAI of the listed real estate firms with inventory from 2002–2020. Table 1 shows summary statistics for the relevant variables.

4.5.2 *q* values of the 116 listed real estate firms

Figure 2 shows the ratio of investments to fixed assets, and the before- and after-tax marginal and average *q* values, of the 116 listed real estate firms from 2002–2020. The mean before- and after-tax marginal *q* values, and the average *q* value, were 1.7043, 1.1260, and 1.3164, respectively.

4.5.3 Results of regression analysis

Table 2 shows the results of the regression analysis. Both marginal *q* and average *q* had a significant positive impact on investments, regardless of year; these results support *Hypothesis 1*.

4.5.4 Comparison with the literature

Wan and Qiu (2023) estimated the before- and after-tax marginal q, and the average q, of 19 listed real estate firms in China from 2002–2020 (2.5780, 1.6883, and 1.3590, respectively); our results are similar. However, the before-tax marginal and average q values for real estate firms in Japan in the 1980s were 1.5400 and -0.1896, respectively, as reported by Ogawa (1994); these values are lower than those in our study.

5 Conclusion

We estimated the depreciation rates of 116 listed real estate firms in China with inventories according to the DEAI. The mean rate was 0.0033, which is low but still close to that of Qiu and Wan (2021a). We also estimated before- and after-tax marginal and average q values. The mean before- and after-tax marginal q values, and the average q value, were 1.7043, 1.1260, and 1.3164 for the 116 firms, and 1.7140, 1.1791, and 1.3133 for 97 firms after removing the 19 firms in Qiu and Wan (2021a), respectively. This result can be explained by the marginal q including housing bubble profits in an ongoing housing bubble, while the stock market bubble burst. According to panel estimation, the investments of these firms were significantly correlated with the marginal and average q values; this implies real estate firm overinvestments.

One implication of this study is that overinvestment could be more serious and prevalent than currently thought, as indicated by the 19 firms examined in the study by Qiu and Wan (2021a). The example of Japan indicates that systematic bankruptcy and economic and financial crisis follow overinvestments when the housing market

stagnates. Therefore, preventing a hard landing in the housing market is a key issue for China.

Two issues are left for future research, i.e., how to deal with the inventories of firms, and with the decline in corporate profits during the COVID-19 pandemic. Notably, we were unable to clarify the impact of the pandemic on fluctuations in housing prices; this requires additional study.

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Table 1(a) : Summary statistics of the 116 listed real estate firms

Variable	Obs	Median	Mean	Std.Dev.	Min	Max
After-tax Marginal q (t)	1148	0.7829	1.126041	1.216095	-1.8027	7.3107
Before-tax Marginal q (t)	1148	1.1363	1.704293	1.76997	-1.8015	12.1304
Average q (t)	1148	1.1842	1.316407	0.5768756	0.0869	7.411
Depreciation rate	1148	0.0019	0.0033116	0.0131892	-0.1078	0.0903
Investment (t) / Fixed Assets (t-1)	1148	0.0825	0.186713	0.2960997	-0.0241	2.5647
Year	2100	2010.5	2010.5	5.767655	2001	2020

Source: Authors' estimations based on data from the balance sheets.

Table 1(b): The mean value of depreciation rate, ratio of investment to fixed assets, after-tax Marginal q, before-tax Marginal q and Average q of the 116 listed real estate firms

year	depreciation rate	ratio of investment to fixed assets	after-tax Marginal q(t)	before-tax Marginal q(t)	Average q(t)
2002	0.0154	0.2426	0.2247	0.4230	0.4819
2003	0.0066	0.2027	1.4283	1.9094	0.7759
2004	0.0051	0.1538	1.5338	2.2626	0.9945
2005	-0.0049	0.0545	1.4627	1.9507	0.8107
2006	0.0027	0.1157	2.0318	2.8573	1.5333
2007	0.0106	0.2385	2.3096	3.2597	2.3774
2008	0.0022	0.1547	1.5107	2.1337	1.5645
2009	0.0002	0.1028	1.3662	1.8464	1.8991
2010	0.0007	0.1109	1.6724	2.4397	1.5149
2011	0.0051	0.1336	1.3109	1.8473	1.3440
2012	0.0035	0.1491	1.2212	1.7892	1.2246
2013	0.0016	0.1272	1.1790	1.8567	1.2390
2014	0.0036	0.1387	1.0418	1.6055	1.2329
2015	0.0034	0.1482	0.8416	1.3272	1.4296
2016	0.0040	0.2029	0.9469	1.4506	1.4671
2017	0.0023	0.2913	1.2636	1.9079	1.3537
2018	0.0029	0.2682	1.1755	1.8589	1.2299
2019	0.0043	0.2296	1.0664	1.6287	1.1542
2020	0.0040	0.1885	0.7262	1.1633	1.0794
avg.	0.0039	0.1712	1.2796	1.8694	1.3003

Source: Authors' estimations based on data from the balance sheets.

Table 2(a): Determinants of investment of the 116 real estate listed firms (reduced form)

(Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment $_{(t)}$ / Fixed Assets $_{(t-1)}$		
Before-tax Marginal $q_{(t)}$			0.0370 ***
			(0.0136)
After-tax Marginal $q_{(t)}$		0.0540 ***	
		(0.0204)	
Average $q_{(t)}$	0.0542 **		
	(0.0228)		
Year	0.0104 **	0.0116 **	0.0113 **
	(0.0040)	(0.0048)	(0.0047)
Constant	-20.8269 **	-23.2712 **	-22.6801 **
	(8.1535)	(9.6878)	(9.4356)
Observations	1,148	1,148	1,148
R-squared	0.0269	0.0429	0.0407
Number of firms	116	116	116

Note: Robust standard errors in parentheses (FE), *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2(b): Determinants of investment of the 16 real estate listed firms (reduced form)

(Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment $_{(t)}$ / Fixed Assets $_{(t-1)}$		
Before-tax Marginal $q_{(t)}$			0.0327 **
			(0.0140)
After-tax Marginal $q_{(t)}$		0.0475 *	
		(0.0215)	
Average $q_{(t)}$	0.0491 **		
	(0.0199)		
Constant	0.1320 ***	0.1508 ***	0.1478 ***
	(0.0374)	(0.0222)	(0.0232)
Year 2002 (dropped)			
Year 2003	0.1548	0.2088	0.2123
	(0.0400)	(0.0415)	(0.0422)
Year 2004	0.1531	0.1281	0.1385
	(0.1162)	(0.1141)	(0.1210)
Year 2005	0.0534	0.0221	0.0210
	(0.1297)	(0.1382)	(0.1448)
Year 2006	-0.0461	-0.0815	-0.0740
	(0.0391)	(0.0466)	(0.0436)
Year 2007	-0.0236	-0.0474	-0.0421
	(0.0421)	(0.0518)	(0.0492)
Year 2008	0.0497	0.0436	0.0495
	(0.0584)	(0.0828)	(0.0791)
Year 2009	-0.0039	-0.0247	-0.0209
	(0.0486)	(0.0558)	(0.0540)
Year 2010	-0.0925	-0.0940	-0.0888
	(0.0408)	(0.0549)	(0.0520)
Year 2011	-0.0984	-0.1321	-0.1314
	(0.0467)	(0.0619)	(0.0601)
Year 2012	-0.0707	-0.0924	-0.0902
	(0.0472)	(0.0578)	(0.0559)
Year 2013	-0.0583	-0.0774	-0.0757
	(0.0443)	(0.0518)	(0.0505)
Year 2014	-0.0642	-0.0752	-0.0765
	(0.0385)	(0.0453)	(0.0450)
Year 2015	-0.0570	-0.0622	-0.0613
	(0.0369)	(0.0393)	(0.0387)
Year 2016	-0.0599	-0.0458	-0.0454
	(0.0314)	(0.0374)	(0.0333)
Year 2017	-0.0065	0.0024	0.0035
	(0.0342)	(0.0374)	(0.0371)
Year 2018	0.0893	0.0773	0.0785
	(0.0372)	(0.0413)	(0.0405)
Year 2019	0.0723	0.0583	0.0570
	(0.0265)	(0.0273)	(0.0273)
Year 2020	0.0374	0.0249	0.0259
	(0.0195)	(0.0202)	(0.0196)
Observations	1148	1148	1148
R-squared	0.0683	0.0792	0.0778
Number of firms	116	116	116

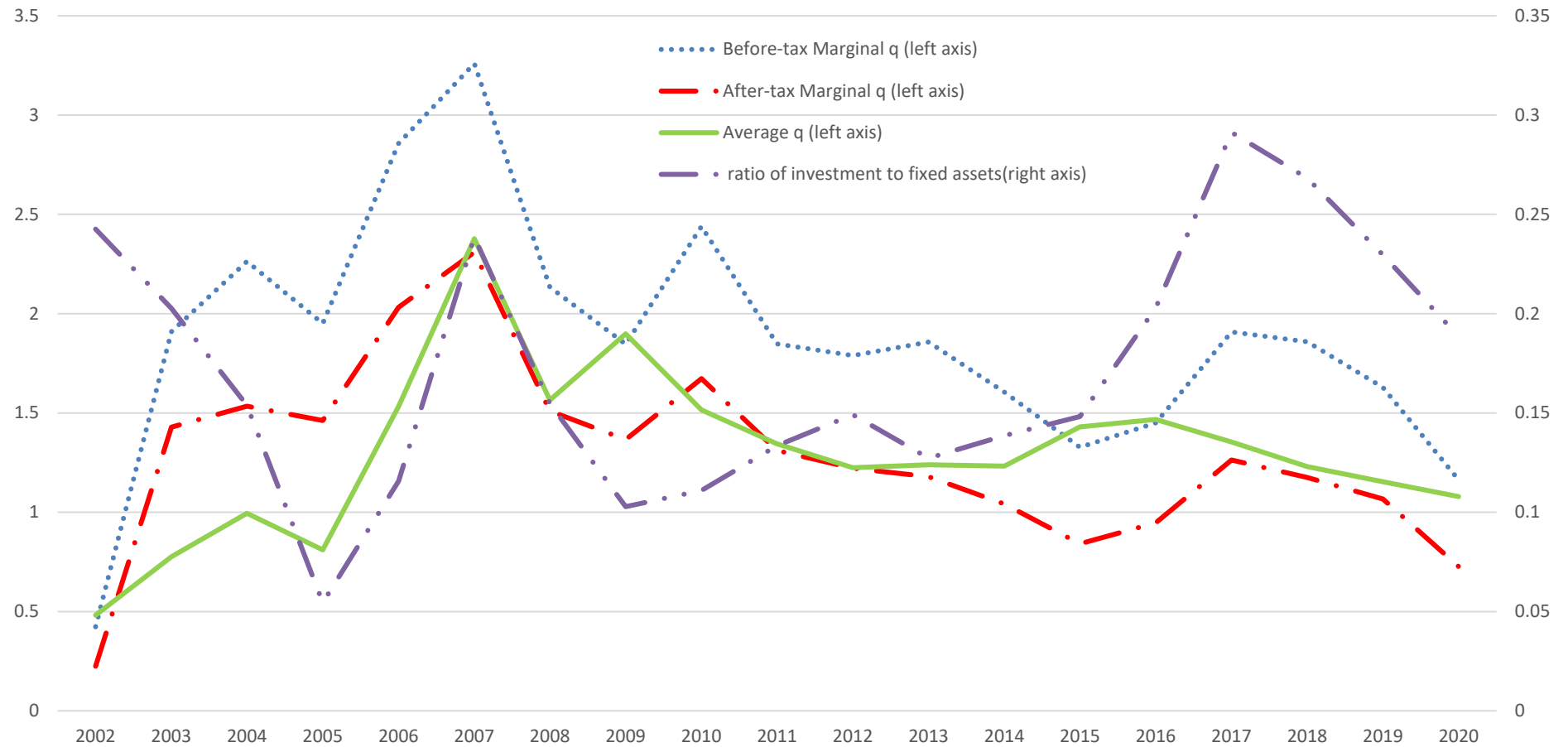Note: Robust standard errors in parentheses (FE), *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Mean value of depreciation rate of the 116 listed real estate firms by year
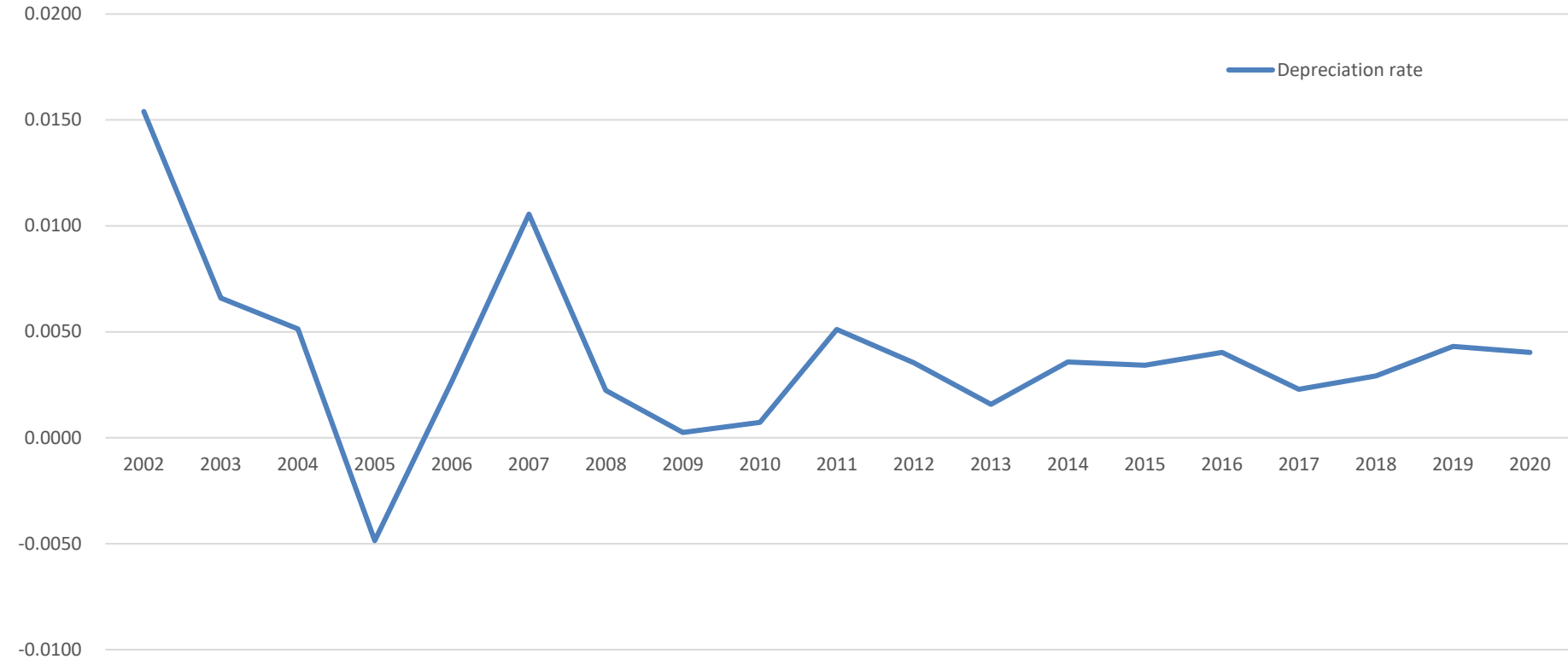
Source: Authors' estimations based on data from the balance sheets.

Figure 2: Mean value of Marginal *q*, Average *q* and ratio of investment to fixed assets of the 116 listed real estate firms by year

Source: Authors' estimations based on data from the balance sheets.