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Residential Investments and Housing Prices in China

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Abstract

This paper estimates the depreciation rate by Depreciation Expense as Accounting Item (DEAI) with and without inventory, the before- and after-tax Marginal q , and the Average q of the top 19 listed real estate firms in China. The Average values of these firms' before-tax Marginal q and Average q are higher than the value of real estate firms in 1980s Japan. The value of before- and after-tax Marginal q is significantly higher than the value of Average q in China, similar to the real estate sector and almost all sectors in Japan, as reported by Ogawa et al. (1994), while strikingly opposite to findings reported by Chirinko and Schaller (2001) whereby Average q was higher than Marginal q for Japan's listed firms during the 1980s. The high Marginal q value suggests that real estate firms obtain bubble profit by selling bubbly housing. The before- and after-tax Marginal q and Average q of the China Evergrande Group drastically decreased from 13.8307, 8.0304, 2.0198 in 2010 to 1.1330, 0.5213, 0.9791 in 2020, respectively. Thus there are overinvestments in the China Evergrande Group and the other similar firms based on Tobin's q theory. The depreciation rate and investment can be explained by economic depreciation theory and Tobin's q theory using panel estimations. This indicates overinvestment caused by bubbly Marginal q in China's real estate sector.

JEL classification: E13, E22, D24

Keywords: after-tax Marginal q , Average q , before-tax Marginal q , China, investment, overinvestment, listed real estate firms

1 Introduction

1.1 Debt crisis of real estate firms in China

The bond of China's largest real estate firm—the China Evergrande Group—was rated Ca by Moody's assessment on September 7, 2021. It was reported that many defaulted debts may ensue in the U.S. bond market (Nikkei, September 11, 2021), indicating a considerable possibility of default for the influenced firm.² Chinese real estate firms headed by the China Evergrande Group defaulted on central debt and were instructed by the People's Bank China and the Ministry of Housing and Urban-Rural Development of China on August 23, 2020 to prevent a systemic financial crisis.³ The China Evergrande Group experienced a double crash in share and bond prices and was subsequently similarly instructed again by the People's Bank China and the China Banking and Insurance Regulatory Commission on August 19, 2021.⁴ Real estate firms' debt default has clearly been an intensifying issue in China. Herein, we analyze the potential reasons for this.

1.2 Housing bubble, stock price bubble, and real investment of real estate firms

As real estate firms are housing suppliers, there is a natural tendency to assume that the current phenomenon has been caused by the housing market's intensifying bubble. Several studies have highlighted serious housing bubbles in major cities and nationwide in China, including Wan (2015, 2018a and 2018c) and Wan and Qiu (2020). Herein, we investigate possible causes of this debt crisis. The debt's major purpose is investment and speculation on land, fixed assets, and inventory; therefore, the major reason for the debt crisis may be overinvestment driven by the additional profit derived from making and selling housing in a price bubble.

Bubbles and crashes are also known to affect China's stock markets (Wan 2018c). The top 19 real estate firms have been listed, highlighting empirical and theoretical problems with respect to how investors evaluate or price real estate firms by creating a

²<https://www.moody.com/zh-cn/credit-ratings/Hengda-Real-Estate-Group-Company-Limited-credit-rating-830343731/ratings/view-by-class>

³ <http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/4075935/index.html>

⁴ bankdevelopmenthttp://www.cbirc.gov.cn/cn/view/pages/ItemDetail.html?docId=1002663&itemId=915&generaltype=0

bubble. Based on Tobin's Marginal q theory, the marginal product of selling bubbly housing may induce additional corporative profit to increase Marginal q . Moreover, based on Tobin's Average q theory, stock market evaluations of bubbly profit (flow, the first source of stock market bubble) and fixed capital (the second source of stock bubble) may increase Average q . While the stock markets witnessed numerous price crashes, no nationwide crash occurred in China's real estate market. Herein, we will clarify how the real investment of real estate firms has been affected by q theory within both housing price bubbles and stock price bubbles under different market structures and different investors. We will compare further our methodology and results with the situation in Japan to identify differences or similarities, since the stock market and real estate market in Japan crashed in 1989 and 1991, respectively.

1.3 Contributions

We used data from the 19 listed real estate firms to estimate the depreciation rate in China. We used the same data to estimate these firms' before- and after-tax Marginal q and Average q . The Average value of before-tax Marginal q here is significantly higher than that of real estate firms in 1980s Japan, as reported by Ogawa et al. (1994). The high value of before- and after-tax Marginal q could be from the housing bubble, which could induce overinvestment. We further found that the before-tax Marginal q is significantly higher than the after-tax Marginal q and Average q , and the after-tax Marginal q is significantly higher than the Average q . Our findings are similar to those from Japan during the 1980s, as reported by Ogawa et al. (1994) but strikingly dissimilar from Chirinko and Schaller's (2001) findings pertaining to 1980s Japan wherein Average q equaled the summation of Marginal q and the stock price bubble. Replacement and new fixed and inventory investments can be explained by Marginal and Average q theory; hence, overinvestment issues may arise for real estate firms during housing bubble eras.

The China Evergrande Group has been in debt crisis. The before- and after-tax Marginal q and Average q drastically decreased from 13.8307, 8.0304, 2.0198 in 2010 to 1.1330, 0.5213 (<1), 0.9791(<1) in 2020, respectively. The q with value lower than

1 after the bubble crash implies that there are overinvestments based on Tobin q theory, thus there are overinvestments in the China Evergrande Group and the other similar firms.

1.4 Structure of this research

The remainder of the paper is organized as follows. The research question and hypotheses are presented in Section 2. Section 3 describes the data sources and the estimations of depreciation rate, before- and after-tax Marginal q , and Average q . The empirical specifications and results are summarized in Section 4. Section 5 summarizes the conclusions.

2 Research question and hypotheses

2.1 Housing bubble, investment, and q in real estate firms in China

In view of the serious housing bubble in China, real estate firms may derive additional profit from selling housing within a price bubble. Thereby, both the Marginal and Average q will have bubbly profit. Regarding the relationship between investment and q under a housing bubble; we predict the following:

Hypothesis 1: The depreciation rate of real estate firms in China is raised by the ratio of profit after tax because replacement investment could be accelerated by economic depreciation theory (Wan 2019).

Hypothesis 2: The investment behavior of real estate firms in China can be explained by the Marginal and Average q , whereby these q may include additional profits from the bubble (Tobin 1963, 1969).

The main point of the above two hypotheses is that overinvestments may occur as a result of bubbly Marginal q and bubbly Average q .

3 Depreciation rate, Marginal q , Average q and investment of the 19 listed real

estate firms

3.1 Panel data on the 19 listed real estate firms

We collected panel data from the balance sheets via the official homepages of the 19 listed real estate firms by year. We selected the top 20 real estate firms through the 2019–2021 comprehensive strength evaluation list of Chinese real estate development firms of the China Real Estate Association (<http://cp.fangchan.com/#/>). We excluded real estate firms dominated by leasing and construction businesses and those without annual financial reports. We also collected the yearly Average stock price of each firm from the website (<https://cn.investing.com/equities>).

3.2 Estimations of depreciation rates by DEAI

Total Value of Fixed Assets with and without inventory

Owing to the particularity of real estate firms, the fixed assets in the balance sheets of real estate firms account for a small portion of the total assets, while the inventory accounts for a large portion of the total assets, and the profits of real estate enterprises are mainly derived from the inventory by speculative motive. Therefore, inventory should be included in the total value fixed assets (TVFA), and TVFA with inventory should be similar to the fixed assets of real estate firms. Compared with Ogawa et al.'s (1994) findings, which omitted land price from the estimation of q in Japan's real estate firms, the profits of real estate firms here are mainly derived from the sale of bubbly housing, and land premium cannot be excluded because the land, inventory, and TVFA are indivisible. We use the following formula to estimate TVFA with inventory:

$$TVFAHI_{it} = TVFA_{it} + Inventroy_{it}, \quad (1)$$

where

$TVFA_{it}$: total value of fixed assets of i real estate firm at time t , and

$TVFAHI_{it}$: total value of fixed assets with inventory of i real estate firm at time t .

Estimation of depreciation rate by DEAI

We estimate the depreciation rate by DEAI, following Wan and Qiu (2021) and Qiu

and Wan (2021).⁵ The particularity of real estate firms leads to two types of depreciation rate by DEAI: the first is the TVFA without inventory, and the second is the TVFA with inventory, which is used to estimate Marginal q in this study. We control inflation by the Average value of the Price Index for Investment in Fixed Assets (PIIFA) to estimate the two types of depreciation rate. DEAI with and without inventory is estimated using the following formula:

$$\begin{aligned}\delta_{DEAI-it (with inventory)} &= \frac{(AD_{it}-AD_{it-1})/PIIFA_t}{TVFAHI_{it-1}}, \\ \delta_{DEAI-it (without inventory)} &= \frac{(AD_{it}-AD_{it-1})/PIIFA_t}{TVFA_{it-1}},\end{aligned}\quad (2)$$

where

$\delta_{DEAI-it(with inventory)}$: depreciation rate values by DEAI with inventory of i real estate firm at time t ;

$\delta_{DEAI-it(without inventory)}$: depreciation rate by DEAI without inventory of i real estate firm at time t ; and

AD_{it} : the accumulated depreciation of i real estate firm at time t .

Table 1 shows the two types of depreciation rate by DEAI for the 19 listed real estate firms. Figure 1 shows the trend of the two kinds of Average values of the 19 listed real estate firms by year.

3.3 Estimation of before- and after-tax Marginal q and Average q

Estimation of before- and after-tax Marginal q of the 19 listed real estate firms

We estimated the before- and after-tax Marginal q of 19 real estate firms in China. Because we used TVFA with inventory as the fixed assets to estimate the ratio of profits before and after tax and Marginal q , the Average value of depreciation rate by DEAI with inventory is used to estimate the Marginal q of the 19 listed real estate firms. We also estimated the interest ratio of the 19 listed real estate firms by firm data on interest payments by year, and the average interest ratio value of each firm is used to estimate

⁵ Due to the rise of housing price, the inventory in the fixed assets of real estate firms has increased, and the depreciation rate by perpetual inventory method (PIM) will be negative; we do not report the depreciation rate by PIM, but they are available upon requests.

the Marginal q . We estimated Marginal q following Ogawa et al. (1994), Wan and Qiu (2020), and Qiu and Wan (2021) using the following formula:

$$Mq_{it} = \frac{\pi_{it}}{P_{it}^I} \frac{1+r_i}{r_i+\delta_{DEAI-i}}, \quad (3)$$

where

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

π_{it} : ratio of total profit before- and after-tax (with inventory) of i real estate firm at time t ;

P_{it}^I : investment of i real estate firm at time t ;

δ_{DEAI-i} : average value of depreciation rate by DEAI (with inventory) of i real estate firm during the sample period; and

r_i : average value of interest payments of industrial sectors of i real estate firm during the sample period.

Table 2 shows the before-tax and after-tax Marginal q values by year for the 19 listed real estate firms in China. Figure 2 and Figure 3-21 show the trend of the average value by year and annual before- and after-tax Marginal q of the 19 listed real estate firms in China.

Estimation of Average q of the 19 listed real estate firms

We estimated the Average q of the 19 listed real estate firms in China. We followed Tobin (1963) and Tobin (1969) to estimate the Average q using the following formula:

$$Aq_{it} = \frac{EMV_{it}+TD_{it}}{TA_{it}}, \quad (3)$$

where

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

EMV_{it} : equity market value (*Average Stock Price of Per Share*All Shares*) of i real estate firm at time t ;

TD_{it} : total book value of debt of i real estate firm at time t ; and

TA_{it} : total book value of assets of i real estate firm at time t .

The value of the Average q of 19 listed real estate firms in China by year is shown

in Table 2. The trend of the average value by year and annual Average q of the 19 listed real estate firms are shown in Figure 2 and Figure 3-21, respectively.

As described in the first section of this study, the China Evergrande Group has been in debt crisis to experience a double crash in share and bond prices. The before- and after-tax Marginal q and Average q drastically decreased from 13.8307, 8.0304, 2.0198 in 2010 to 1.1330, 0.5213 (<1), 0.9791(<1) in 2020, respectively. We term the high q here as bubble Marginal q and bubble Average q , and predict that this bubble q could be lower than 1 after the bubble crash. The q with value lower than 1 after the bubble crash implies that there are overinvestments based on Tobin q theory. We conclude that there are overinvestments in the China Evergrande Group and the other similar firms.

Data issues and their solutions

We used the AD to estimate the annual depreciation of fixed assets (DFA). Owing to the liquidation or reduction of fixed assets, the AD decreased, resulting in a negative annual depreciation. Since DEAI should not be negative in theory, we used the average value to replace the negative values of some firms for some years (Sunac China Holdings Limited for 2010, Kaisa Group Holdings Ltd., China Merchants Shekou Industrial Zone Holdings Co., Ltd. for 2020, and Yango Group for 2014). Green Land was backdoor listed before 2015, and so there were outliers of DEAI and q , which we replaced with the average value. The Jinke Property Group Co., Ltd. and China Fortune Land Development Co., Ltd. were engaged in manufacturing before 2011 and 2012, respectively, and so we excluded these previous data. The data replaced by the average are underlined in Tables 1 and 2.

4 Empirical specifications and estimated results

4.1 Depreciation rate by DEAI and ratio of profit

We consider the empirical specification following Wan and Qiu (2021) to analyze whether the depreciation rate by DEAI (with and without inventory) of the 19 listed real estate firms can be explained by the economic depreciation hypothesis (Hypothesis 1) by Wan (2019).

$$\delta_{DEAI-it \text{ (with inventory)}} = \alpha_0 + \alpha_1 RPFHI_{it} + \alpha_2 RHIFA_{it} + \theta_i + \eta_t + \kappa_{mt},$$

$$\delta_{DEAI-it \text{ (without inventory)}} = \beta_0 + \beta_1 RPFHI_{it} + \beta_2 RHIFA_{it} + \tau_i + \rho_t + \varepsilon_{mt}, \quad (4)$$

where

$RPFHI_{it}$: *Total Profits After Tax* $_{it}$ / *TVAHI* $_{it-1}$ of i real estate firm at time t . We confirm the economic depreciation hypothesis that the $RPFHI$ may have a positive and significant impact on DEAI (with and without inventory).

$RHIFA_{it}$: *TVAHI* $_{it}$ / *Total Assets* $_{it-1}$ of i real estate firm at time t . We consider that $RHIFA$ may capture the impact of the fixed asset sizes of different firms on the depreciation rate.

$\alpha_1, \alpha_2, \beta_1$ and β_2 are coefficients, α_0 and β_0 are constant terms, τ_i and θ_i are firm-specific effects, ρ_t and η_t are time effects (time trend or dummy by year), and ε_{mt} and κ_{mt} are random errors, respectively. We use panel estimation with fixed effects and robust standard errors to obtain the parameters and draw inferences.

4.2 Investment, Marginal, and Average q

We consider the following empirical specifications of the investment function based on Abel (1980), Chirinko (1993), Ogawa et al. (1994, 2019) and Wan and Qiu (2020):

$$\frac{I_{it}}{K_{it-1}} = \zeta_0 + \zeta_1 q_{it} + \zeta_2 RHIFA_{it} + \mu_i + \gamma_t + \varepsilon_{it}, \quad (5)$$

where

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

q_{it} : before-tax Marginal q , after-tax Marginal q , and Average q of i real estate firm at time t ; and ζ_1 and ζ_2 are coefficients and ζ_0, μ_i, γ_t , and ε_{it} are the constant term, firm-specific effects, time effects (time trend or dummy by year), and random errors, respectively.

We use the panel estimation method with fixed effects and robust standard errors to obtain the parameters and draw inferences. The specification of Eq. (5) can test Hypothesis 2.

Following Chirinko (1993, Eq. (17)) and Wan and Qiu (2020), we consider the

structural form of the adjustment cost model for Marginal and Average q .

$$\frac{I_{it}}{K_{it-1}} = \tau + \frac{1}{a}(q_{it} - 1)P_{it}^I + \zeta_2 RTHIA_{it} + \mu_i + \gamma_t + \varepsilon_{mt}, \quad (6)$$

where

a and τ are parameters of quadratic adjustment cost function.

We also use the specification of Eq. (6) to test Hypothesis 2 by the structural form of the adjustment cost model for Marginal and Average q .

4.3 Empirical results

Depreciation rate by DEAI of 19 listed real estate firms

The average yearly depreciation rate values of the 19 listed real estate firms by EDAl (with and without inventory) during the period 2002–2020 are shown in Figure 1. The depreciation rate values of the 19 listed real estate firms by DEAI are shown in Table 1. Table 3 shows the summary statistics of the DEAI and other related variables. Table 4 shows the empirical results. The profits after tax of the 19 listed real estate firms have a significant impact on the depreciation rate by DEAI (with and without inventory), regardless of controlling for size of fixed asset, time trend, and year dummies. This result supports Wan's (2019) economic depreciation hypothesis.

Investment of 19 listed real estate firms

Figure 2 shows the average value of before- and after-tax Marginal q and Average q of 19 listed real estate firms by year from 2002 to 2020. The values of before- and after-tax Marginal q and Average q of each of the 19 listed real estate firms are shown in Table 2 and visualized in Figure 3-21, respectively. The mean values of before- and after-tax Marginal q and Average q in this study are 2.5780, 1.6883, and 1.3590, respectively. The before-tax Marginal q and Average q are higher than the 1.54 and -0.1896 values of Japanese real estate firms in the 1980s, as reported by Ogawa et al. (1994). That high value of Marginal q implies that the firm makes an additional profit from the housing bubble by demand-side driving theory in Wan (2021a). A part of the investment caused by the bubble profit could be considered as overinvestment. The result of this study is close to that of Japan in 1980s by Ogawa et al. (1994). Difference tests revealed that the value of before-tax Marginal q is significantly higher than the

after-tax Marginal q and Average q in the 19 listed real estate firms in China. Difference tests also revealed that the after-tax Marginal q is significantly higher than the Average q . The result here may be explained by the fact that the Marginal q includes more profit from the housing bubble than the Average q in the 19 listed real estate firms and is simply opposite to the results that Chirinko and Schaller (2001) reported for 1980s Japan.

Tables 5 and 6 present the empirical results for reduced form and structural form with adjustment cost, respectively. The before- and after-tax Marginal q and Average q have significant impacts on the investment regardless of controlling for size of fixed assets, time trend, and year dummies. These results indicate that Tobin's q theory explains the investment behavior of the 19 listed real estate firms and support Hypothesis 2. The elasticity values of the before- and after-tax Marginal q and Average q are 0.1594, 0.1072, and 0.1059, respectively. The elasticity here is lower than the before-tax Marginal q (0.2412) of the 13 housing-related industries studied by Wan and Qiu (2020).

5 Conclusion

We estimated the depreciation rate by DEAI (with and without inventory) of 19 listed real estate firms in China. The mean values of DEAI without and with inventory for the 19 listed real estate firms are 0.1104 and 0.0034 (used for estimation of Marginal q), respectively. We found that the depreciation rate by DEAI (without and with inventory) of the 19 listed real estate firms is accounted for by economic depreciation theory.

We also estimated the before- and after-tax Marginal q and Average q of the 19 listed real estate firms. The average before- and after-tax Marginal q and Average q values are 2.5780, 1.6883, and 1.3590, respectively. The before-tax Marginal q and Average q values (1.5400 and -0.1896, respectively) of real estate firms in 1980s Japan, as reported by Ogawa et al. (1994), are lower than those observed in this study. The value of before-tax Marginal q is significantly higher than the values of after-tax Marginal q and Average q of 19 listed real estate firms in China, as confirmed by the

difference test. The difference test also verified that the after-tax Marginal q value is significantly higher than the Average q values of the 19 listed real estate firms in China. The elasticities of the before- and after-tax Marginal q and Average q on investment for the 19 listed real estate firms are 0.1594, 0.1072, and 0.1059, respectively. This elasticity of the before-tax Marginal q (0.1594) is lower than that of the 13 housing-related industries (0.2412) studied by Wan and Qiu (2020). Finally, we found that the investment of the 19 listed real estate firms in China can be accounted for by Tobin's Marginal and Average q theory.

The implications of the empirical results are as follows. The high Marginal q values of the 19 listed real estate firms suggest that firms may obtain bubble profits from the housing bubble in line with demand-side driving theory (Wan, 2021a). Via bubbly Marginal q , the investment behavior of the 19 listed real estate firms may be interpreted as overinvestment. The higher before-tax Marginal q compared with the after-tax Marginal q indicates that the before-tax Marginal q should derive greater profit from the bubble than the after-tax Marginal q and Average q . The higher after-tax Marginal q compared with Average q suggests that the after-tax Marginal q includes more profit from the bubble than Average q . The Marginal q may include more profit from the bubble than the Average q of the 19 real estate firms because the stock market has experienced several bubble bursts. A stock market burst may cause the bubble in the stock price to be squeezed out, as argued by Wan (2018c). This suggests that the Average q is smaller than the Marginal q of the real estate sector and almost all sectors in 1980s Japan, as reported by Ogawa et al. (1994), which contrasts with the findings of Chirinko and Schaller's (2001) study on Japan during the 1980s. The low elasticity values of before- and after-tax Marginal q and Average q may imply that the 19 listed real estate firms have higher adjustment costs than the 13 housing-related industries that Wan and Qiu (2020) investigated. This may point toward overinvestment in the 19 listed real estate firms in China. Compared with Wan and Qiu's (2020) findings from industrial sectors, Wan's (2018c) examination of banking sectors, and Qiu's (2021c) findings from the construction sector, this study offers new evidence to help identify

overinvestment issues in real estate firms that operate as makers and sellers of housing bubbles.

The China Evergrande Group has been in debt crisis to experience a double crash in share and bond prices. The before- and after-tax Marginal q and Average q drastically decreased from 13.8307, 8.0304, 2.0198 in 2010 to 1.1330, 0.5213 (<1), 0.9791(<1) in 2020, respectively. The q with value lower than 1 after the bubble crash implies that there are overinvestments based on Tobin q theory. Hence, there are overinvestments in the China Evergrande Group and the other similar firms.

To resolve overinvestment issues in the industrial, construction, and banking sectors, we must first solve the problem of overinvestment in real estate firms. A bubble crash in the real estate sector could cause financial system risk; thus, it is necessary to ensure a soft landing for house prices, following Wan (2018a, 2021b). Future studies should analyze the impact of the housing bubble on local housing firms using data from local listed real estate firms and by incorporating macro policy variables. Our methods and results should be compared with those reported by Chirinko and Schaller (2001).

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Table 1: Depreciation rates of the 19 listed real estate firms by Depreciation Expense as Accounting Item (DEAI) with and without inventory.

Year	Evergrande Group		China Fortune Land Development Co., Ltd.		Sunac China Holdings Limited		Agile		Kaisa Group Holdings Ltd.		China Merchants Shekou Industrial Zone Holdings Co., Ltd.		Seazen Holdings Co., Ltd.	
	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory
2009	0.1248	0.0048												
2010	0.2499	0.0043			<u>0.2622</u>	<u>0.0013</u>	0.0253	0.0018	0.1835	0.0020				
2011	0.2185	0.0049			0.4728	0.0009	0.0303	0.0017	0.1131	0.0011				
2012	0.0810	0.0038	0.1260	0.0013	0.3085	0.0003	0.0461	0.0029	0.2656	0.0017				
2013	0.0875	0.0048	0.1604	0.0010	0.4229	0.0004	0.0374	0.0029	0.2044	0.0018				
2014	0.0858	0.0050	0.1222	0.0017	0.2519	0.0003	0.0288	0.0027	0.4058	0.0045				
2015	0.0819	0.0048	0.0932	0.0019	0.3468	0.0004	0.0519	0.0043	0.1045	0.0011			0.0768	0.0015
2016	0.0614	0.0026	0.1130	0.0026	0.3500	0.0005	0.0697	0.0060	0.1277	0.0012	0.0594	0.0012	0.0567	0.0024
2017	0.0794	0.0024	0.0938	0.0017	0.4011	0.0017	0.0689	0.0072	0.1035	0.0014	0.0516	0.0012	0.0679	0.0023
2018	0.0575	0.0019	0.1490	0.0018	0.0205	0.0023	0.0678	0.0061	0.0681	0.0020	0.0347	0.0006	0.0860	0.0018
2019	0.0580	0.0021	0.1390	0.0027	0.0238	0.0030	0.0879	0.0070	0.0820	0.0031	0.1199	0.0019	0.0922	0.0010
2020	0.0436	0.0018	0.0591	0.0015	0.0238	0.0030	0.0802	0.0069	<u>0.1350</u>	<u>0.0020</u>	<u>0.0664</u>	<u>0.0012</u>	0.0130	0.0001
Avg.	0.1024	0.0036	0.1173	0.0018	0.2622	0.0013	0.0540	0.0045	0.1630	0.0020	0.0664	0.0012	0.0654	0.0015

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

Table 1: Depreciation rates of the 19 listed real estate firms by Depreciation Expense as Accounting Item (DEAI) with and without inventory (cont.).

Year	China Aoyuan Property Group Limited		Country Garden		Cifi Group		China Vanke Co., Ltd.		Creen Town		Yango Group	
	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory
2007	0.6169	0.0234	0.1158	0.0165								
2008	0.0674	0.0016	0.0928	0.0121			0.0828	0.0007			0.0669	0.0011
2009	0.0326	0.0010	0.0646	0.0073			0.0246	0.0004	0.0557	0.0028	0.1064	0.0010
2010	0.0478	0.0011	0.0585	0.0053			0.0487	0.0007	0.0406	0.0024	0.0610	0.0005
2011	0.0669	0.0050	0.0516	0.0052			0.0572	0.0005	0.0491	0.0019	0.2181	0.0013
2012	0.2821	0.0157	0.0443	0.0047	0.1144	0.0010	0.0493	0.0004	0.0784	0.0030	0.5605	0.0036
2013	0.0877	0.0028	0.0411	0.0056	0.0473	0.0003	0.0586	0.0004	0.0624	0.0041	0.3760	0.0010
2014	0.0586	0.0012	0.0415	0.0046	0.1701	0.0005	0.0617	0.0004	0.0337	0.0028	<u>0.1642</u>	<u>0.0009</u>
2015	0.0603	0.0012	0.0291	0.0027	0.2558	0.0008	0.0757	0.0005	0.0322	0.0031	0.3847	0.0002
2016	0.0812	0.0012	0.0426	0.0034	0.1914	0.0003	0.0808	0.0010	0.0245	0.0022	0.1642	0.0008
2017	0.0979	0.0011	0.0190	0.0012	0.1285	0.0003	0.0539	0.0007	0.0156	0.0012	0.3643	0.0032
2018	0.1519	0.0014	0.0740	0.0031	0.3913	0.0008	0.1871	0.0021	0.0514	0.0035	0.0104	0.0002
2019	0.0757	0.0013	0.0508	0.0014	0.1684	0.0003	0.0574	0.0008	0.0539	0.0036	0.0366	0.0006
2020	0.0526	0.0009	0.0797	0.0019	0.2750	0.0004	0.0571	0.0007	0.0406	0.0024	0.0248	0.0005
Avg.	0.1271	0.0042	0.0575	0.0053	0.1936	0.0005	0.0688	0.0007	0.0448	0.0027	0.1952	0.0012

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

Table 1: Depreciation rates of the 19 listed real estate firms by Depreciation Expense as Accounting Item (DEAI) with and without inventory (cont.).

Year	Poly Development Holding Group Co., Ltd		Hangzhou Binjiang Real Estate Group Co., Ltd.		Gemdale Group		R&F Group		Green Land		Jinke Property Group Co., Ltd.	
	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory	DEAI without inventory	DEAI with inventory
2002					0.0429	0.0086						
2003					0.0394	0.0038						
2004					0.0735	0.0034			<u>0.0490</u>	<u>0.0124</u>		
2005					0.0752	0.0034	0.0370		<u>0.0512</u>	<u>0.0044</u>		
2006					0.0780	0.0025	0.1969	0.0028	<u>0.0308</u>	<u>0.0129</u>		
2007					0.0335	0.0006	0.0651	0.0095	0.0427	0.0013		
2008					0.2585	0.0011	0.0656	0.0069	0.0189	0.0045		
2009	0.1153	0.0005	0.1602	0.0025	0.1043	0.0003	0.0525	0.0086	<u>0.0136</u>	<u>0.0146</u>		
2010	0.1545	0.0005	0.2024	0.0015	0.1580	0.0003	0.0606	0.0055	0.0005	0.0001		
2011	0.1593	0.0005	0.4278	0.0024	0.1787	0.0004	0.0481	0.0052	0.0004	0.0001	0.2264	0.0025
2012	0.0978	0.0006	0.1190	0.0020	0.0789	0.0002	0.0628	0.0059	0.0400	0.0056	0.1633	0.0010
2013	0.0785	0.0006	0.1394	0.0019	0.2126	0.0006	0.0498	0.0051	<u>0.0780</u>	<u>0.0019</u>	0.0648	0.0009
2014	0.0596	0.0005	0.1546	0.0020	0.1347	0.0005	0.0537	0.0048	<u>0.0760</u>	<u>0.0218</u>	0.1167	0.0014
2015	0.0718	0.0007	0.1914	0.0020	0.1388	0.0005	0.0460	0.0032	<u>0.0778</u>	0.1176	0.1097	0.0020
2016	0.0568	0.0006	0.2266	0.0022	0.1556	0.0006	0.0745	0.0061	0.0041	0.0001	0.0730	0.0025
2017	0.1082	0.0011	0.1107	0.0011	0.0618	0.0010	0.4150	0.0381	0.0710	0.0013	0.0211	0.0008
2018	0.1098	0.0010	0.1261	0.0012	0.0697	0.0009	0.0393	0.0075	0.1297	0.0032	0.0777	0.0017
2019	0.1380	0.0013	0.2229	0.0009	0.0752	0.0007	0.0333	0.0051	0.1218	0.0050	0.1072	0.0016
2020	0.0175	0.0002	0.0594	0.0004	0.0581	0.0005			0.0621	0.0037	0.0605	0.0012
Avg.	0.0973	0.0007	0.1784	0.0017	0.1067	0.0016	0.0867	0.0082	0.0510	0.0124	0.1020	0.0015

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

Table 2: Before-tax Marginal q , after-tax Marginal q , and Average q of the 19 listed real estate firms.

Year	Evergrande Group			China Fortune Land Development Co., Ltd.			Sunac China Holdings Limited			Agile			Kaisa Group Holdings Ltd.		
	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q
2009	2.8300	2.1855													
2010	13.8307	8.0304	2.0198				12.0381	7.1428	2.0148	7.6927	4.4752	1.8425	9.8116	6.6742	1.4625
2011	8.2667	4.7814	1.9703				10.5981	7.1582	2.0934	5.3187	2.3948	1.2769	3.9701	2.6692	1.5509
2012	3.6190	2.0152	1.4159	7.0960	5.2568	0.3509	1.8138	2.8154	2.0574	3.3302	1.6275	1.1433	2.1625	1.3997	1.2139
2013	3.7160	2.0059	1.3348	6.4911	4.8626	0.8238	3.3740	2.0737	1.3712	2.8710	1.5711	1.1590	2.2907	1.2718	1.3250
2014	3.6522	2.1095	1.1672	5.4274	4.0776	1.3795	2.3333	1.5388	1.1274	2.5248	1.2694	0.8762	0.4241	-0.3761	1.3543
2015	2.7515	1.5173	1.4339	5.1098	3.6673	3.1200	2.5455	2.0127	1.0549	1.3014	0.4834	0.7277	0.0336	-0.2429	1.0119
2016	2.1079	1.0074	1.6133	5.1240	3.5213	1.9854	2.4318	1.6207	2.4039	1.7510	0.7136	0.8609	0.3575	-0.0665	1.1805
2017	2.6187	1.2523	1.2863	5.0169	3.4519	1.8285	3.1262	2.3742	2.2305	4.1019	1.7526	1.1249	1.3433	0.6133	1.2329
2018	2.9520	1.5497	1.0582	4.4058	2.9832	0.9220	2.1344	1.2990	1.2290	4.1301	1.7792	1.3415	1.3635	0.5780	0.9957
2019	1.5019	0.6792	1.1249	5.0414	3.3263	1.2192	2.8259	1.8701	1.4043	2.7156	1.5108	1.0612	1.7898	0.7872	1.0221
2020	1.1330	0.5213	0.9791	1.5887	0.9483	0.8677	2.6861	1.8464	1.1297	2.8191	1.6082	0.9902	2.0006	1.0055	0.9274
Avg.	4.0816	2.3046	1.4003	5.0334	3.5662	1.3886	4.1734	2.8865	1.6470	3.5051	1.7442	1.1277	2.3225	1.3012	1.2070

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

Table 2: Before-tax Marginal q , after-tax Marginal q , and Average q of the 19 listed real estate firms (cont.).

Year	China Aoyuan Property Group Limited			Country Garden			Cifi Group			China Vanke Co., Ltd.			Creen Town		
	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q
2007	12.5562	6.2821	6.0401	19.5970	12.0954	11.1325									
2008	-0.3776	0.2430	0.9232	4.9985	2.1688	2.5275				2.0538	1.5073	1.8961			
2009	1.0321	0.7834	1.1160	2.4589	1.6043	1.6952				2.1613	1.6127	1.6806	0.8566	0.5958	1.7757
2010	1.2649	0.6212	0.8948	2.9900	1.9212	1.5036				2.8419	2.1038	1.8257	1.2921	0.8249	1.6490
2011	1.4549	0.8616	1.0160	3.3261	2.0213	1.5002				2.5625	1.8805	1.4514	0.6689	0.9386	0.9532
2012	1.9408	1.1868	0.9594	2.8902	1.7239	1.4027	3.2879	2.3398	1.4436	2.1849	1.6241	1.3394	1.1425	1.1665	0.7478
2013	1.1918	0.7086	1.2692	3.0245	1.9862	1.7311	2.6292	1.8040	1.4356	0.6579	0.6579	1.2688	2.3697	1.5520	1.1109
2014	0.8197	0.4430	1.0357	2.1852	1.4166	1.2978	2.7440	1.6503	1.0414	0.7444	0.7546	1.0186	2.5275	0.7909	0.8934
2015	0.8318	0.4006	1.1183	1.4044	0.9195	1.2611	3.5045	2.2757	1.4554	0.6624	0.6624	1.2423	1.4899	0.2800	0.9684
2016	0.7254	0.3502	1.1392	1.6162	1.0323	1.5955	2.5074	1.6404	1.2453	0.7299	0.7299	1.5026	0.7583	0.4496	0.9821
2017	0.9252	0.4981	1.5973	2.6710	1.6508	1.8920	5.0156	3.0712	1.6267	2.2604	1.6446	1.4863	1.1249	0.4701	1.2092
2018	1.0025	0.4237	1.3704	2.9101	1.7755	1.6313	3.6329	2.2851	1.5172	2.3076	1.6855	1.3544	0.9995	0.3004	1.0053
2019	1.0165	0.5013	1.4613	2.2815	1.4113	1.1754	2.0170	1.3452	1.2262	2.0386	1.4684	1.1507	1.0130	0.4005	1.0008
2020	0.9454	0.4898	1.0110	1.5710	0.9941	1.0276	1.4865	0.9929	1.0552	1.7647	1.3134	1.0536	0.9573	0.5130	1.0396
Avg.	1.8093	0.9852	1.4966	3.8518	2.3372	2.2410	2.9805	1.9338	1.3385	1.7670	1.3573	1.4054	1.2667	0.6902	1.1113

Source: Authors' estimations based on data from the balance sheet of firms.

Table 2: Before-tax Marginal q , after-tax Marginal q , and Average q of the 19 listed real estate firms (cont.).

Year	Poly Development Holding Group Co., Ltd			Hangzhou Binjiang Real Estate Group Co., Ltd.			Gemdale Group			R&F Group			Green Land		
	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q
2003							1.6554	0.7407							
2004							1.0156	0.5628	0.6922				4.9301	3.0869	0.8257
2005							0.9610	0.7550	0.6645	7.1123	7.1123	1.3250	1.7180	1.4561	0.4343
2006							1.1031	0.7370	1.2162	10.0523	6.8840	1.5492	2.4984	1.9833	1.0117
2007							1.1145	1.3097	1.9225	18.3110	12.0015	2.3205	2.5462	2.4647	1.0450
2008							1.7795	0.5050	1.2736	5.4682	3.3874	0.9483	6.3775	5.2116	0.9442
2009	2.2900	1.7062	1.5803	2.6315	1.9777	1.1878	0.7114	0.5851	1.4996	4.8080	2.8908	1.0790	4.3972	3.5740	1.3160
2010	2.1110	1.5695	1.6068	3.3427	2.4643	1.3245	0.7560	0.6657	1.4511	4.2140	2.3270	0.9928	4.8906	3.6561	1.3934
2011	1.5714	1.1492	1.2101	1.4731	1.0946	1.1244	0.8980	0.7089	1.2293	4.8618	2.5638	0.8835	2.4910	2.1146	1.4204
2012	1.5202	1.1210	1.2597	1.1662	0.8601	1.0132	0.9464	0.5765	1.0673	4.6772	2.6360	0.9432	0.9669	0.8500	1.2310
2013	1.4492	1.0679	1.1701	1.1546	0.8262	0.9294	0.7909	0.5536	1.1172	4.9058	2.9139	1.1812	0.6414	0.4902	1.1630
2014	1.3527	1.0115	1.1018	0.7137	0.4954	0.8256	0.7747	0.5569	0.9676	2.7833	1.7830	0.9035	<u>3.1457</u>	<u>2.4223</u>	1.6490
2015	1.4600	1.0729	1.1377	1.1646	0.8454	1.2320	0.7979	0.5392	1.1491	2.2096	1.2787	0.8173	<u>1.0221</u>	<u>0.6932</u>	<u>1.1303</u>
2016	1.3752	1.0072	1.1274	1.7129	1.1990	1.1734	0.6992	0.9497	1.1102	2.1768	1.2941	1.0170	0.8504	0.5534	1.1422
2017	1.4415	1.1037	1.4070	2.0684	1.6326	1.2625	1.2409	1.1210	1.2780	4.8435	3.6442	1.0739	0.9401	0.6624	1.0572
2018	1.3882	1.0145	1.1635	3.2628	2.4249	1.3713	1.3815	1.2247	1.2350	1.9184	0.9886	1.0308	1.1076	0.7313	1.1839
2019	1.8133	1.3476	1.1366	1.8862	1.3869	1.3464	1.5289	1.1794	1.0895	1.6202	0.8972	0.9766	1.1800	0.8080	1.0527
2020	1.5272	1.1641	1.1269	1.0554	0.7822	1.1973	1.4878	0.9327	1.0922	1.2464	0.7165	0.8361	1.0324	0.7110	1.1466
Avg.	1.6083	1.1946	1.2523	1.8027	1.3324	1.1656	1.0913	0.7891	1.1797	5.0755	3.3324	1.1174	2.3962	1.8511	1.1263

Source: Authors' estimations based on data from the balance sheet of firms.

Table 2: Before-tax Marginal q , after-tax Marginal q , and Average q of the 19 listed real estate firms (cont.).

Year	Jinke Property Group Co., Ltd.			Seazen Holdings Co., Ltd.			Yango Group			China Merchants Shekou Industrial Zone Holdings Co., Ltd.		
	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q	Before-tax Marginal q	After-tax Marginal q	Average q
2008							0.9754	0.8325	0.7487			
2009							1.8198	1.3721	0.8070			
2010							4.7344	3.5094	1.1031			
2011							1.8804	1.2757	1.5645			
2012	1.0688	0.8038	1.2031				2.4384	1.7815	1.0250			
2013	0.6605	0.4932	1.0273				1.2437	0.8350	1.9740			
2014	0.2866	0.3282	1.1377				1.2078	0.8419	1.3202			
2015	0.4983	0.3444	1.2445	0.8804	0.6420		0.9693	0.7115	1.7329			
2016	0.5288	0.4243	1.0606	0.9199	0.6767	0.5430	0.6746	0.4703	1.7116	3.0330	2.2429	2.2879
2017	0.7021	0.5452	1.4759	1.4883	1.1131	0.8113	0.6701	0.4143	1.6672	4.0483	2.9306	1.4527
2018	0.8409	0.6489	1.3886	1.5077	1.1674	2.5574	0.4977	0.3043	1.1558	3.6314	2.6484	2.2639
2019	0.9040	0.6894	1.3035	0.9225	0.6903	1.4868	0.4899	0.3127	1.0655	2.7813	2.0076	3.0352
2020	0.9861	0.7857	1.0764	0.7198	0.5330	1.2008	0.6629	0.4127	1.0348	1.7356	1.2176	2.9128
Avg.	0.7196	0.5626	1.2131	1.0731	0.8038	1.3199	1.4050	1.0057	1.3008	3.0459	2.2094	2.3905

Source: Authors' estimations based on data from the balance sheet of firms.

Table 3: Summary statistics of the 19 listed real estate firms.

Variable	Obs	Median	Mean	Std. Dev.	Min	Max
Depreciation Expense as Accounting Item $_{(t)}$ / Total Value of Fixed Assets without Inventory $_{(t-1)}$	224	0.0757	0.1104	0.1036	0.0004	0.6169
Depreciation Expense as Accounting Item $_{(t)}$ / Total Value of Fixed Assets with Inventory $_{(t-1)}$	225	0.0017	0.0034	0.0087	0.0001	0.1176
Before-tax Marginal $q_{(t)}$	224	1.8016	2.5780	2.6496	-0.3776	19.5970
After-tax Marginal $q_{(t)}$	224	1.2083	1.6883	1.7070	-0.3761	12.0954
Average $q_{(t)}$	221	1.2031	1.3590	0.8377	0.3509	11.1325
[Beforetax Marginal $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	224	0.8114	1.5973	2.6821	-1.3945	18.8248
[Aftertax Marginal $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	224	0.2108	0.6967	1.7279	-1.3930	11.2313
[Average $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	221	0.2166	0.3674	0.8457	-0.6571	10.2566
Investment $_{(t)}$ / Total Value of Fixed Assets $_{(t-1)}$	226	0.1375	0.2054	0.2532	0.0004	1.8949
Total Profits After Tax $_{(t)}$ / Total Value of Fixed Assets with Inventory $_{(t-1)}$	226	0.0689	0.0880	0.0828	-0.0250	0.6284
Total Value of Fixed Assets with Inventory $_{(t)}$ / Total Assets $_{(t-1)}$	223	0.7770	1.0587	3.8246	0.2618	57.7888
Year	361	2011	2011	5.484828	2002	2020

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

Table 4a: Determinants of depreciation rate by Depreciation Expense as Accounting Item (DEAI) of the 19 listed real estate firms (Panel estimation with fixed effect and robust standard errors (FE)).

Independent Variables	Dependent variable = Depreciation Expense as Accounting Item $_{(t)}$ / Total Value of Fixed Assets without Inventory $_{(t-1)}$			
Total Profits After Tax $_{(t)}$ / Total Value of Fixed Assets with Inventory $_{(t-1)}$	0.3189 *	0.3205 *	0.3865 **	0.3965 **
Total Value of Fixed Assets with Inventory $_{(t)}$ / Total Assets $_{(t-1)}$		0.0023 ***		0.0019 ***
Constant	1.1481 (4.0261)	1.0521 (4.0525)	-0.0221 (0.0261)	-0.0251 (0.0262)
Year	-0.0005 (0.0020)	-0.0005 (0.0020)		
Year 2002 (Dropped)				
Year 2003			0.0221 * (0.0110)	0.0221 * (0.0113)
Year 2004			0.0779 *** (0.0152)	0.0651 *** (0.0148)
Year 2005			0.055 ** (0.0234)	0.0804 *** (0.0200)
Year 2006			0.0915 *** (0.0224)	0.0904 *** (0.0207)
Year 2007			0.0700 (0.0632)	0.0665 (0.0645)
Year 2008			0.0881 ** (0.0352)	0.0881 ** (0.0352)
Year 2009			0.0722 *** (0.0141)	0.0666 *** (0.0127)
Year 2010			0.0769 *** (0.0166)	0.0766 *** (0.0166)
Year 2011			0.1305 *** (0.0263)	0.1243 *** (0.0274)
Year 2012			0.1308 *** (0.0317)	0.132 *** (0.0316)
Year 2013			0.1176 *** (0.0263)	0.1189 *** (0.0264)
Year 2014			0.1125 *** (0.0156)	0.1142 *** (0.0157)
Year 2015			0.1235 *** (0.0244)	0.1253 *** (0.0245)
Year 2016			0.1069 *** (0.0193)	0.1087 *** (0.0191)
Year 2017			0.1121 *** (0.0316)	0.1134 *** (0.0312)
Year 2018			0.0932 *** (0.0246)	0.0948 *** (0.0247)
Year 2019			0.0891 *** (0.0187)	0.0909 *** (0.0187)
Year 2020			0.0651 *** (0.0196)	0.0673 *** (0.0199)
Observations	225	222	225	222
R-squared	0.0914	0.1045	0.1604	0.1696
Number of firms	19	19	19	19

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

Table 4b: Determinants of depreciation rate by Depreciation Expense as Accounting Item (DEAI) of the 19 listed real estate firms (Panel estimation with fixed effect and robust standard errors (FE)).

Independent Variables	Dependent variable = Depreciation Expense as Accounting Item $_{(t)}$ / Total Value of Fixed Assets with Inventory $_{(t-1)}$			
Total Profits After Tax $_{(t)}$ / Total Value of Fixed Assets with Inventory $_{(t-1)}$	0.0135 *	0.0136 *	0.0222 **	0.0223 **
	(0.0071)	(0.0071)	(0.0078)	(0.0079)
Total Value of Fixed Assets with Inventory $_{(t)}$ / Total Assets $_{(t-1)}$		0.0000		0.0000
		(0.0000)		(0.0000)
Constant	-0.1454	-0.1601	0.0071 ***	0.0071 ***
	(0.2409)	(0.2562)	(0.0017)	(0.0017)
Year	0.0001	0.0001		
	(0.0001)	(0.0001)		
Year 2002 (Dropped)				
Year 2003			-0.0033 ***	-0.0033 ***
			(0.0005)	(0.0005)
Year 2004			-0.0048 ***	-0.0033 ***
			(0.0008)	(0.0007)
Year 2005			-0.0088 **	-0.0089 **
			(0.0035)	(0.0036)
Year 2006			-0.0086 ***	-0.0087 ***
			(0.0030)	(0.0030)
Year 2007			-0.0087 **	-0.0088 **
			(0.0038)	(0.0039)
Year 2008			-0.0068 ***	-0.0069 ***
			(0.0017)	(0.0017)
Year 2009			-0.0058 ***	-0.0061 ***
			(0.0010)	(0.0009)
Year 2010			-0.0092 ***	-0.0093 ***
			(0.0009)	(0.0009)
Year 2011			-0.0076 ***	-0.0078 ***
			(0.0007)	(0.0007)
Year 2012			-0.0057 ***	-0.0058 ***
			(0.0012)	(0.0012)
Year 2013			-0.0064 ***	-0.0065 ***
			(0.0007)	(0.0007)
Year 2014			-0.0049 ***	-0.005 ***
			(0.0017)	(0.0016)
Year 2015			0.0004	0.0003
			(0.0073)	(0.0072)
Year 2016			-0.0059 ***	-0.0059 ***
			(0.0010)	(0.0009)
Year 2017			-0.0049 **	-0.0049 **
			(0.0021)	(0.0021)
Year 2018			-0.006 ***	-0.0061 ***
			(0.0010)	(0.0009)
Year 2019			-0.0058 ***	-0.0058 ***
			(0.0011)	(0.0010)
Year 2020			-0.006 ***	-0.006 ***
			(0.0011)	(0.0010)
Observations	224	222	224	222
R-squared	0.0142	0.0143	0.0758	0.0766
Number of firms	19	19	19	19

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

Table 5a: Determinants of investments in the 19 listed real estate (reduced form).
(Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment _(t) / Total Value of Fixed Assets with Inventory _(t-1)			
Before-tax Marginal $q_{(t)}$	0.0207 ** (0.0081)	0.0206 ** (0.0083)	0.0151 * (0.0078)	0.0143 * (0.0072)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0229 (0.0940)		-0.0851 (0.1053)
Constant	-21.7265 *** (7.0225)	-20.7271 *** (5.8527)	0.1109 *** (0.0329)	0.2181 * (0.1215)
Year	0.0109 *** (0.0035)	0.0104 *** (0.0029)		
Year 2003 (Dropped)				
Year 2004			-0.0379 (0.0244)	-0.1083 ** (0.0483)
Year 2005			-0.0317 (0.0302)	-0.0551 (0.0664)
Year 2006			0.0886 (0.0640)	0.0684 (0.0628)
Year 2007			0.0638 (0.1022)	0.0546 (0.1030)
Year 2008			-0.0389 (0.0374)	-0.0764 (0.0635)
Year 2009			0.0435 (0.0443)	0.0219 (0.0688)
Year 2010			0.0097 (0.0360)	-0.0199 (0.0435)
Year 2011			0.0263 (0.0339)	0.0003 (0.0524)
Year 2012			-0.0146 (0.0446)	-0.0451 (0.0568)
Year 2013			-0.0164 (0.0334)	-0.0450 (0.0559)
Year 2014			-0.0120 (0.0332)	-0.0487 (0.0593)
Year 2015			0.0027 (0.0370)	-0.0367 (0.0612)
Year 2016			0.1496 *** (0.0444)	0.1096 (0.0669)
Year 2017			0.265 ** (0.0932)	0.233 *** (0.0669)
Year 2018			0.1302 ** (0.0501)	0.0888 (0.0632)
Year 2019			0.0478 (0.0323)	0.0049 (0.0556)
Year 2020			0.0462 (0.0434)	-0.0033 (0.0696)
Observations	224	221	224	221
R-squared	0.0620	0.0604	0.2143	0.2197
Number of firms	19	19	19	19

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

Table 5b: Determinants of investments in the 19 listed real estate (reduced form).
 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = $\text{Investment}_{(t)} / \text{Total Value of Fixed Assets with Inventory}_{(t-1)}$			
After-tax Marginal $q_{(t)}$	0.0320 ** (0.0119)	0.0327 ** (0.0123)	0.0224 * (0.0114)	0.0221 ** (0.0105)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0226 (0.0919)		-0.0849 (0.1043)
Constant	-22.4369 *** (7.3873)	-21.3437 *** (6.1734)	0.1221 *** (0.0284)	0.2272 * (0.1208)
Year	0.0112 *** (0.0037)	0.0107 *** (0.0031)		
Year 2003 (Dropped)				
Year 2004			-0.0405 (0.0276)	-0.1134 ** (0.0484)
Year 2005			-0.0606 (0.0402)	-0.0652 (0.0672)
Year 2006			0.0770 (0.0667)	0.0552 (0.0635)
Year 2007			0.0635 (0.1176)	0.0483 (0.1187)
Year 2008			-0.0474 (0.0423)	-0.0855 (0.0660)
Year 2009			0.0299 (0.0430)	0.0094 (0.0688)
Year 2010			0.0018 (0.0338)	-0.0298 (0.0434)
Year 2011			0.0171 (0.0330)	-0.0097 (0.0529)
Year 2012			-0.0277 (0.0428)	-0.0580 (0.0567)
Year 2013			-0.0266 (0.0329)	-0.0550 (0.0561)
Year 2014			-0.0213 (0.0315)	-0.0576 (0.0589)
Year 2015			-0.0070 (0.0370)	-0.0458 (0.0619)
Year 2016			0.1391 *** (0.0470)	0.1000 (0.0693)
Year 2017			0.2551 ** (0.0942)	0.2232 *** (0.0694)
Year 2018			0.1217 ** (0.0482)	0.0807 (0.0631)
Year 2019			0.0383 (0.0284)	-0.0040 (0.0549)
Year 2020			0.0364 (0.0381)	-0.0123 (0.0680)
Observations	224	221	224	221
R-squared	0.0600	0.0604	0.2127	0.2191
Number of firms	19	19	19	19

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

Table 5c: Determinants of investments in the 19 listed real estate (reduced form).
 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment _(t) / Total Value of Fixed Assets with Inventory _(t-1)			
Average $q_{(t)}$	0.0599 ** (0.0271)	0.0635 * (0.0322)	0.0456 ** (0.0211)	0.0509 * (0.0281)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0737 (0.1076)		-0.1210 (0.1112)
Constant	0.0599 ** (0.0271)	0.0635 * (0.0322)	0.0456 ** (0.0211)	0.0509 * (0.0281)
Year	0.0074 * (0.0036)	0.0066 * (0.0032)		
Year 2004 (Dropped)				
Year 2005			-0.0098 (0.0147)	0.0556 (0.0338)
Year 2006			0.1094 (0.0822)	0.1782 ** (0.0667)
Year 2007			0.0436 (0.0686)	0.1048 (0.0714)
Year 2008			-0.0285 (0.0467)	0.0187 (0.0460)
Year 2009			0.0493 (0.0542)	0.1077 ** (0.0449)
Year 2010			0.0366 (0.0502)	0.0933 * (0.0461)
Year 2011			0.0350 (0.0482)	0.0995 *** (0.0266)
Year 2012			-0.0144 (0.0661)	0.0465 (0.0399)
Year 2013			-0.0229 (0.0524)	0.0403 (0.0337)
Year 2014			-0.0175 (0.0541)	0.0353 (0.0284)
Year 2015			0.0053 (0.0520)	0.054 * (0.0289)
Year 2016			0.1258 * (0.0651)	0.1736 *** (0.0442)
Year 2017			0.2489 ** (0.1060)	0.3064 *** (0.0977)
Year 2018			0.1172 * (0.0609)	0.1625 *** (0.0459)
Year 2019			0.0320 (0.0520)	0.0757 ** (0.0282)
Year 2020			0.0304 (0.0475)	0.0659 (0.0381)
Observations	221	219	221	219
R-squared	0.0682	0.0732	0.2127	0.2252
Number of firms	19	19	19	19

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

Table 6a: Determinants of investments in the 19 listed real estate (adjustment cost model).
(Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment _(t) / Total Value of Fixed Assets with Inventory _(t-1)			
[Before-tax Marginal $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	0.0205 ** (0.0080)	0.0204 ** (0.0082)	0.015 * (0.0077)	0.0141 * (0.0071)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0229 (0.0940)		-0.0851 (0.1053)
Constant	-21.7058 *** (7.0183)	-20.7065 *** (5.8496)	0.1261 *** (0.0254)	0.2324 * (0.1221)
Year	0.0109 *** (0.0035)	0.0104 *** (0.0029)		
Year 2003 (Dropped)				
Year 2004			-0.0379 (0.0244)	-0.1083 ** (0.0483)
Year 2005			-0.0317 (0.0302)	-0.0551 (0.0664)
Year 2006			0.0886 (0.0640)	0.0684 (0.0628)
Year 2007			0.0638 (0.1022)	0.0546 (0.1030)
Year 2008			-0.0389 (0.0374)	-0.0764 (0.0635)
Year 2009			0.0435 (0.0443)	0.0219 (0.0688)
Year 2010			0.0097 (0.0360)	-0.0199 (0.0435)
Year 2011			0.0263 (0.0339)	0.0003 (0.0524)
Year 2012			-0.0146 (0.0446)	-0.0451 (0.0568)
Year 2013			-0.0164 (0.0334)	-0.0450 (0.0559)
Year 2014			-0.0120 (0.0332)	-0.0487 (0.0593)
Year 2015			0.0027 (0.0370)	-0.0367 (0.0612)
Year 2016			0.1496 *** (0.0444)	0.1096 (0.0669)
Year 2017			0.265 ** (0.0932)	0.233 *** (0.0669)
Year 2018			0.1302 ** (0.0501)	0.0888 (0.0632)
Year 2019			0.0478 (0.0323)	0.0049 (0.0556)
Year 2020			0.0462 (0.0434)	-0.0033 (0.0696)
Observations	224	221	224	221
R-squared	0.0620	0.0604	0.2143	0.2197
Number of firms	19	19	19	19

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

Table 6b: Determinants of investments in the 19 listed real estate (adjustment cost model).
 (Panel estimation with fixed effect and robust standard errors (FE))

Independent Variables	Dependent variable = Investment _(t) / Total Value of Fixed Assets with Inventory _(t-1)			
[After-tax Marginal $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	0.0316 ** (0.0118)	0.0323 ** (0.0122)	0.0221 * (0.0113)	0.0219 ** (0.0103)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0226 (0.0919)		-0.0849 (0.1043)
Constant	-22.4048 *** (7.3805)	-21.311 *** (6.1682)	0.1445 *** (0.0176)	0.2494 * (0.1223)
Year	0.0112 *** (0.0037)	0.0107 *** (0.0031)		
Year 2003 (Dropped)				
Year 2004			-0.0405 (0.0276)	-0.1134 ** (0.0484)
Year 2005			-0.0606 (0.0402)	-0.0652 (0.0672)
Year 2006			0.0770 (0.0667)	0.0552 (0.0635)
Year 2007			0.0635 (0.1176)	0.0483 (0.1187)
Year 2008			-0.0474 (0.0423)	-0.0855 (0.0660)
Year 2009			0.0299 (0.0430)	0.0094 (0.0688)
Year 2010			0.0018 (0.0338)	-0.0298 (0.0434)
Year 2011			0.0171 (0.0330)	-0.0097 (0.0529)
Year 2012			-0.0277 (0.0428)	-0.0580 (0.0567)
Year 2013			-0.0266 (0.0329)	-0.0550 (0.0561)
Year 2014			-0.0213 (0.0315)	-0.0576 (0.0589)
Year 2015			-0.0070 (0.0370)	-0.0458 (0.0619)
Year 2016			0.1391 *** (0.0470)	0.1000 (0.0693)
Year 2017			0.2551 ** (0.0942)	0.2232 *** (0.0694)
Year 2018			0.1217 ** (0.0482)	0.0807 (0.0631)
Year 2019			0.0383 (0.0284)	-0.0040 (0.0549)
Year 2020			0.0364 (0.0381)	-0.0123 (0.0680)
Observations	224	221	224	221
R-squared	0.0600	0.0604	0.2127	0.2191
Number of firms	19	19	19	19

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

Table 6c: Determinants of investments in the 19 listed real estate (adjustment cost model).

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

Independent Variables	Dependent variable = Investment _(t) / Total Value of Fixed Assets with Inventory _(t-1)			
[Average $q_{(t)} - 1$]*Price Index for Investment in Fixed Assets	0.0592 ** (0.0268)	0.0628 * (0.0318)	0.045 ** (0.0208)	0.0503 * (0.0278)
Total Value of Fixed Assets with Inventory _(t) / Total Assets _(t-1)		-0.0737 (0.1076)		-0.1210 (0.1112)
Constant	-14.8084 * (7.3225)	-13.0142 * (6.3723)	0.1383 *** (0.0414)	0.1815 ** (0.0820)
Year	0.0074 * (0.0036)	0.0066 * (0.0032)		
Year 2004 (Dropped)				
Year 2005			-0.0098 (0.0147)	0.0556 (0.0338)
Year 2006			0.1094 (0.0822)	0.1782 ** (0.0667)
Year 2007			0.0436 (0.0686)	0.1048 (0.0714)
Year 2008			-0.0285 (0.0467)	0.0187 (0.0460)
Year 2009			0.0493 (0.0542)	0.1077 ** (0.0449)
Year 2010			0.0366 (0.0502)	0.0933 * (0.0461)
Year 2011			0.0350 (0.0482)	0.0995 *** (0.0266)
Year 2012			-0.0144 (0.0661)	0.0465 (0.0399)
Year 2013			-0.0229 (0.0524)	0.0403 (0.0337)
Year 2014			-0.0175 (0.0541)	0.0353 (0.0284)
Year 2015			0.0053 (0.0520)	0.054 * (0.0289)
Year 2016			0.1258 * (0.0651)	0.1736 *** -0.0442
Year 2017			0.2489 ** (0.1060)	0.3064 *** (0.0977)
Year 2018			0.1172 * (0.0609)	0.1625 *** (0.0459)
Year 2019			0.0320 (0.0520)	0.0757 ** (0.0282)
Year 2020			0.0304 (0.0475)	0.0659 (0.0381)
Observations	221	219	221	219
R-squared	0.0682	0.0732	0.2127	0.2252
Number of firms	19	19	19	19

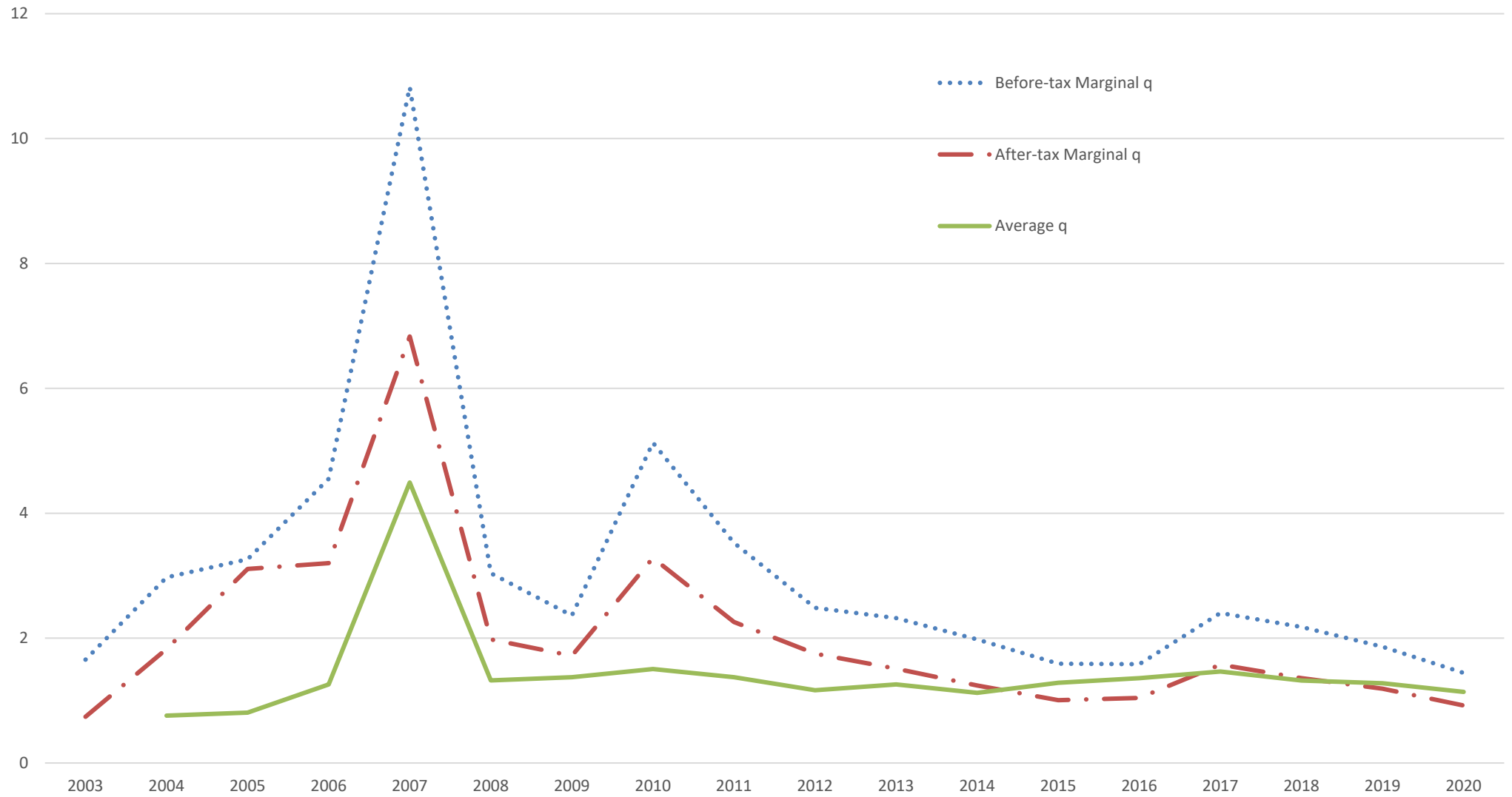
Note: Robust standard errors in parentheses (FE), *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Average value of Depreciation Expense as Accounting Item (DEAI) with and without inventory of the 19 listed real estate firms by year.



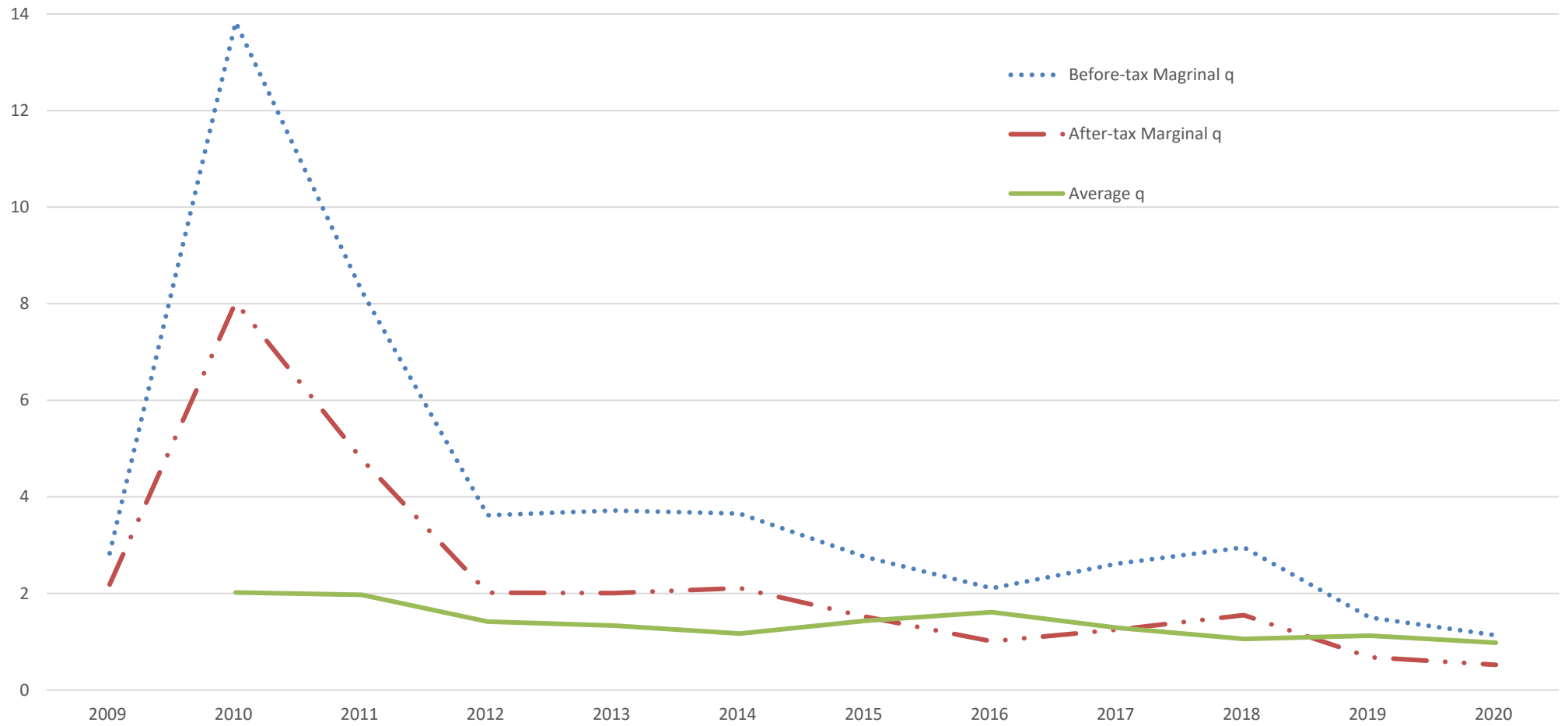
Source: Authors' estimations based on data from the balance sheets.

Figure 2: Average value of before-tax Marginal q , after-tax Marginal q , and Average q of the 19 listed real estate firms by year.



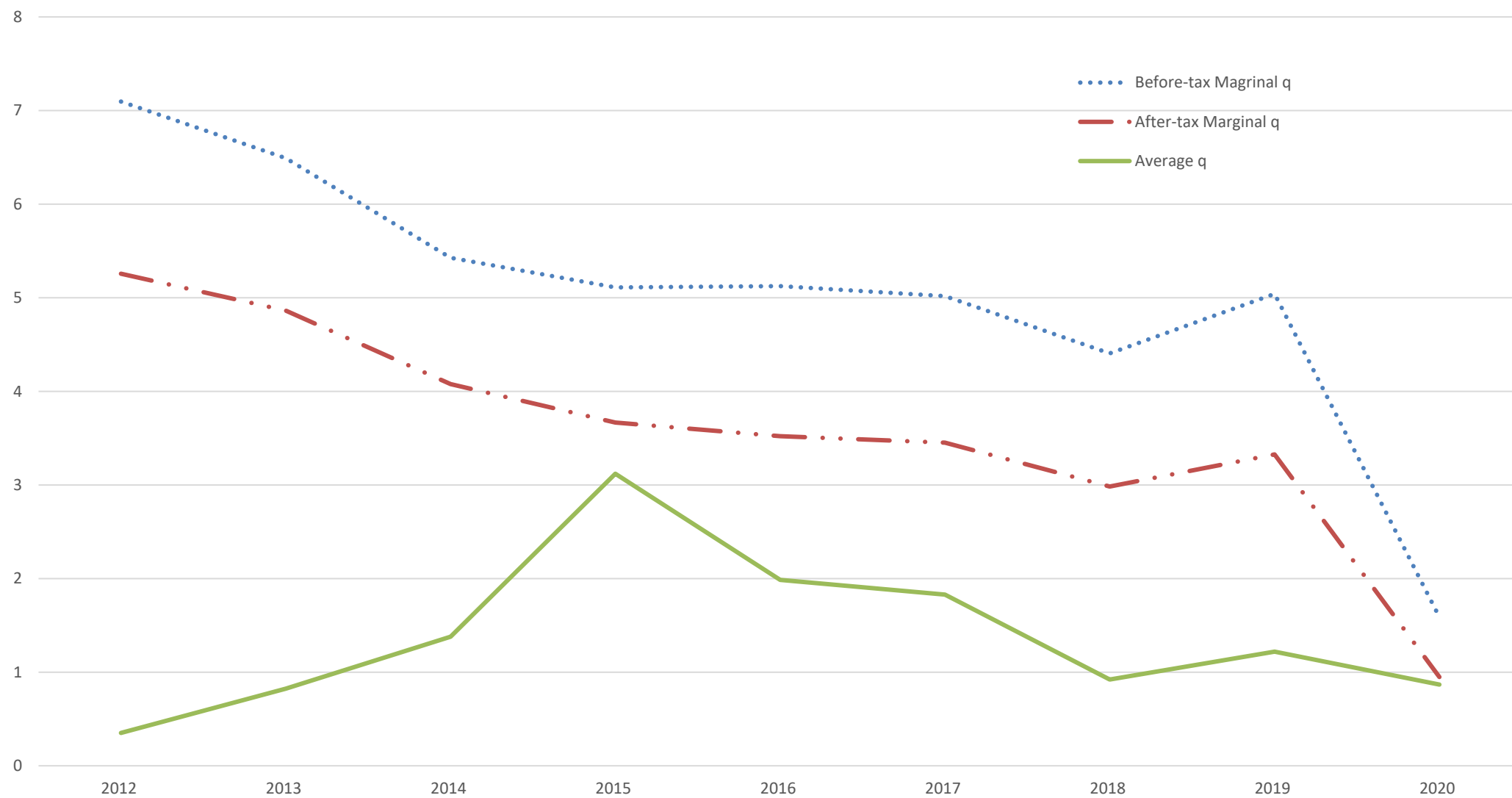
Source: Authors' estimations based on data from the balance sheets.

Figure 3: Before-tax Marginal q , after-tax Marginal q , and Average q of Evergrande Group for the period 2009–2020.



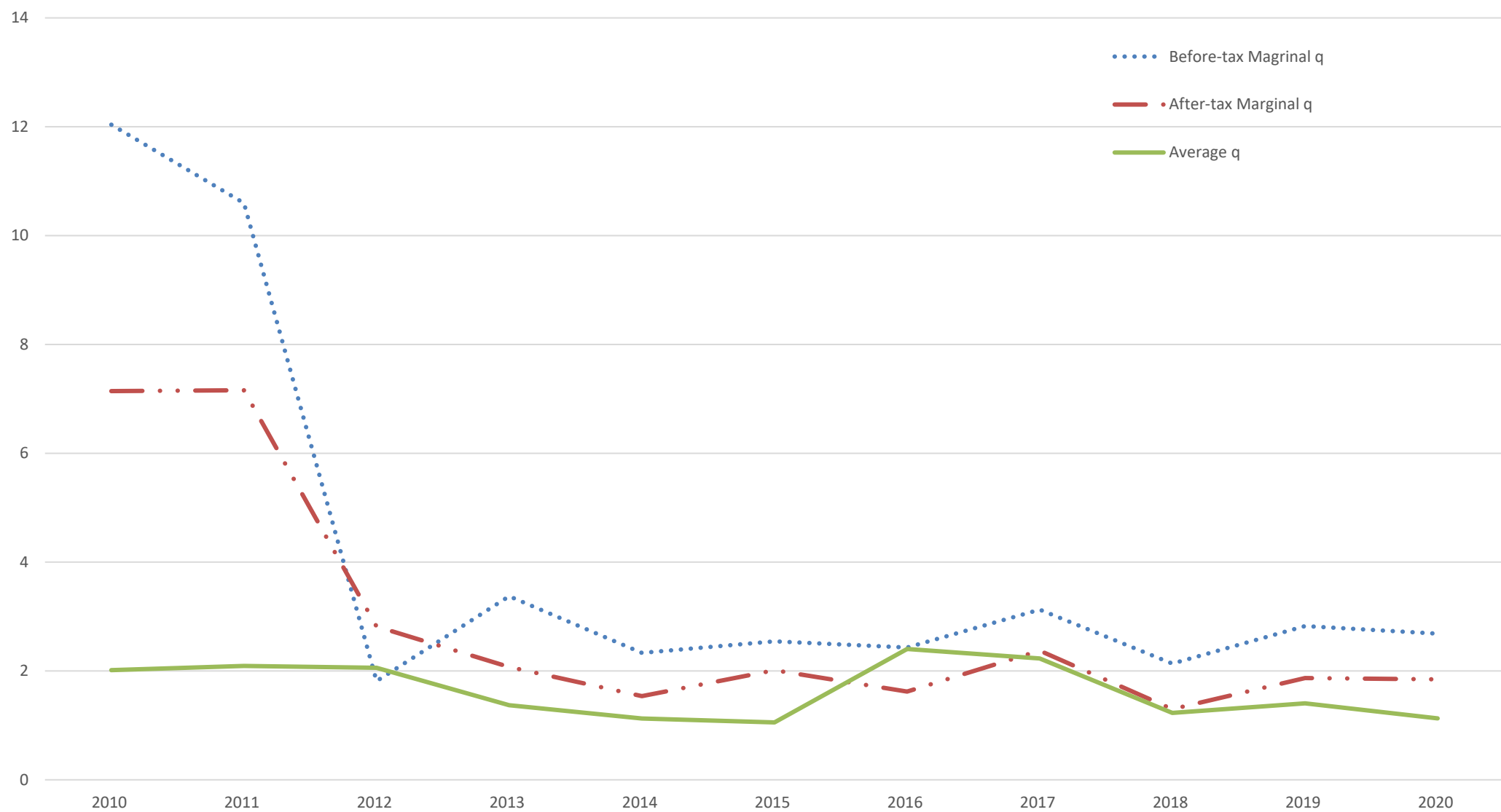
Source: Authors' estimations based on data from the balance sheet of Evergrande Group.

Figure 4: Before-tax Marginal q , after-tax Marginal q , and Average q of China Fortune Land Development Co., Ltd. for the period 2012–2020.



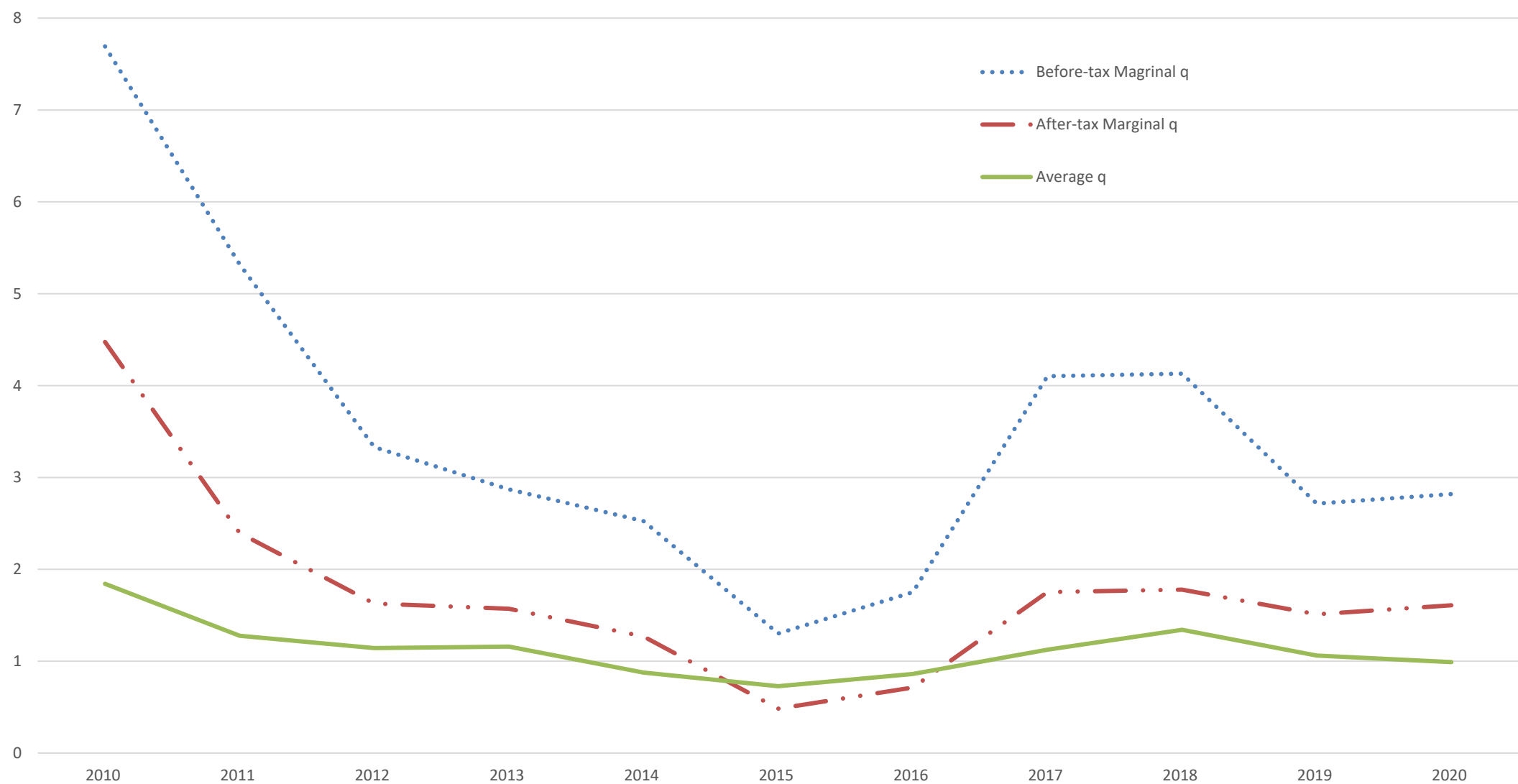
Source: Authors' estimations based on data from the balance sheet of Fortune Land Development Co., Ltd.

Figure 5: Before-tax Marginal q , after-tax Marginal q , and Average q of Sunac China Holdings Limited for the period 2010–2020.



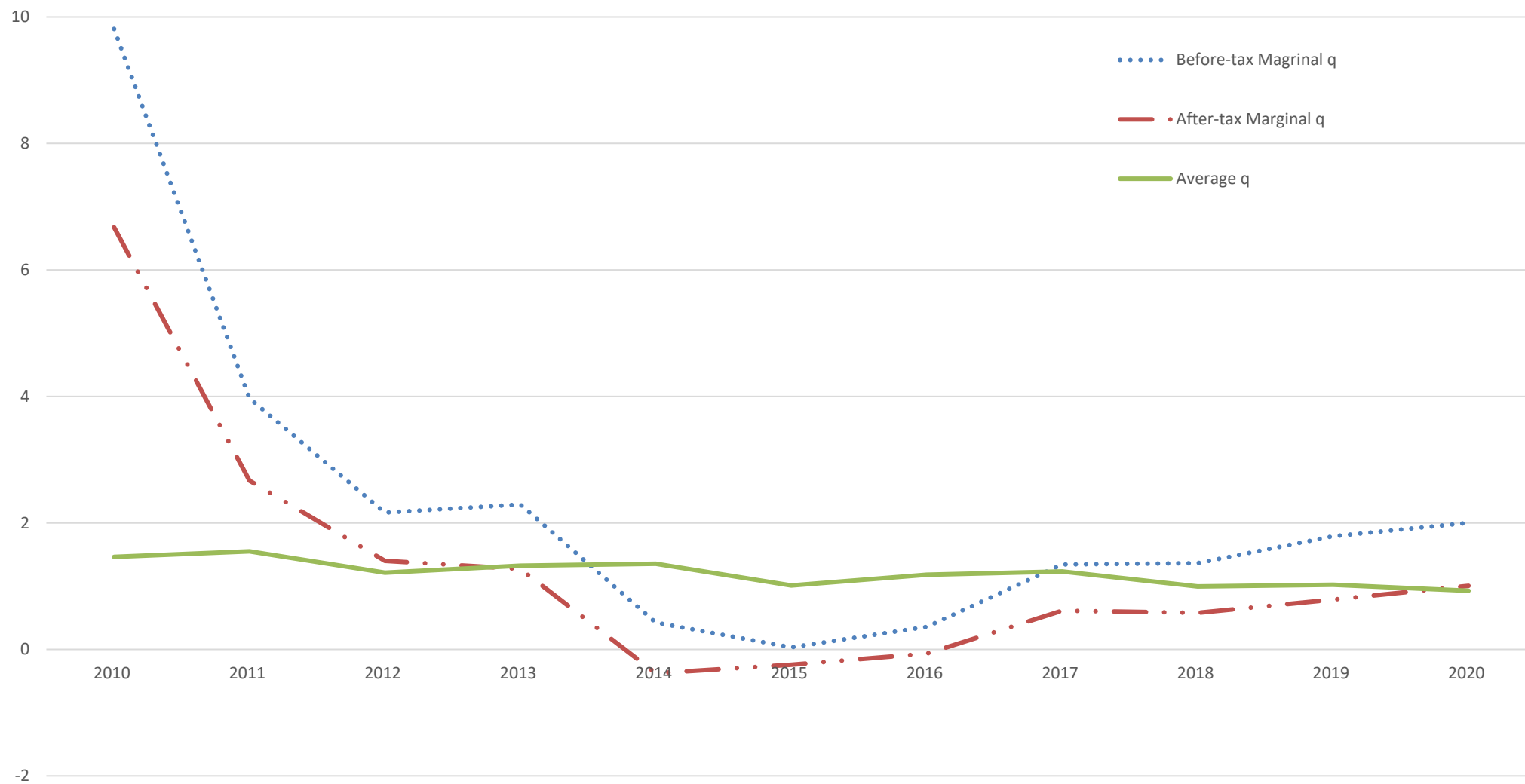
Source: Authors' estimations based on data from the balance sheet of Sunac China Holdings Limited.

Figure 6: Before-tax Marginal q , after-tax Marginal q , and Average q of Agile for the period 2010–2020.



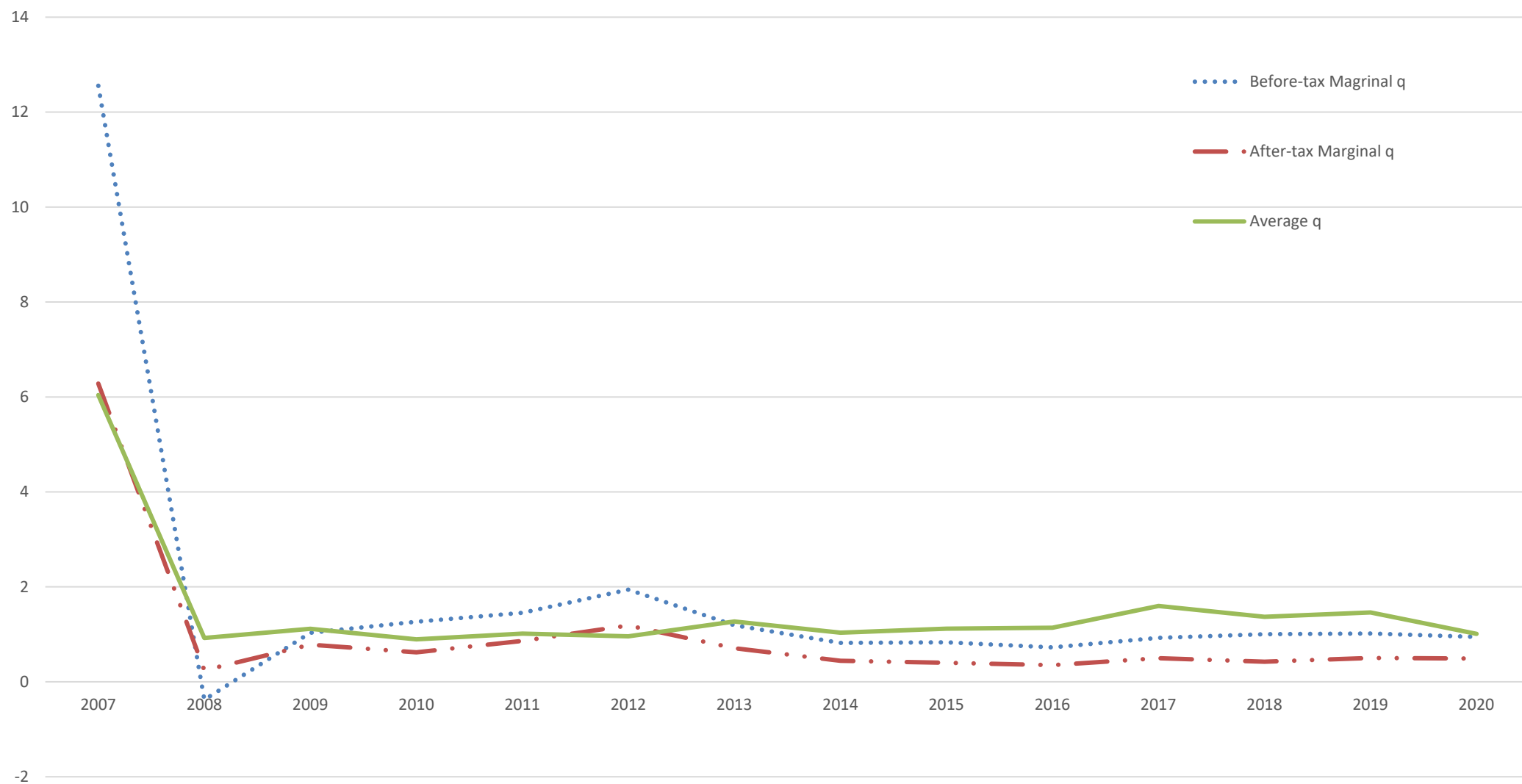
Source: Authors' estimations based on data from the balance sheet of Agile.

Figure 7: Before-tax Marginal q , after-tax Marginal q , and Average q of Kaisa Group Holdings Ltd. for the period 2010–2020.



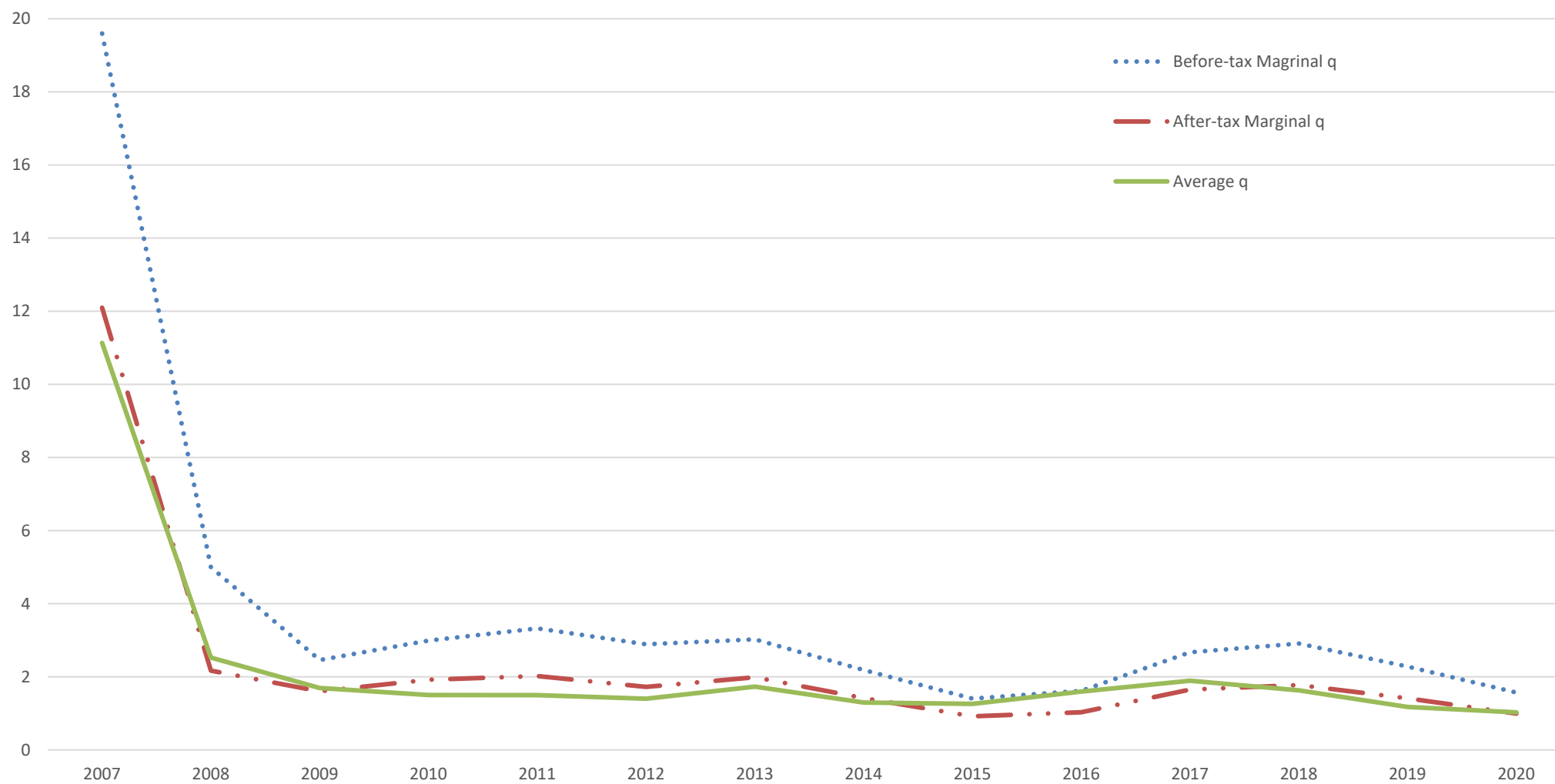
Source: Authors' estimations based on data from the balance sheet of Kaisa Group Holdings Ltd.

Figure 8: Before-tax Marginal q , after-tax Marginal q , and Average q of China Aoyuan Property Group Limited for the period 2007–2020.



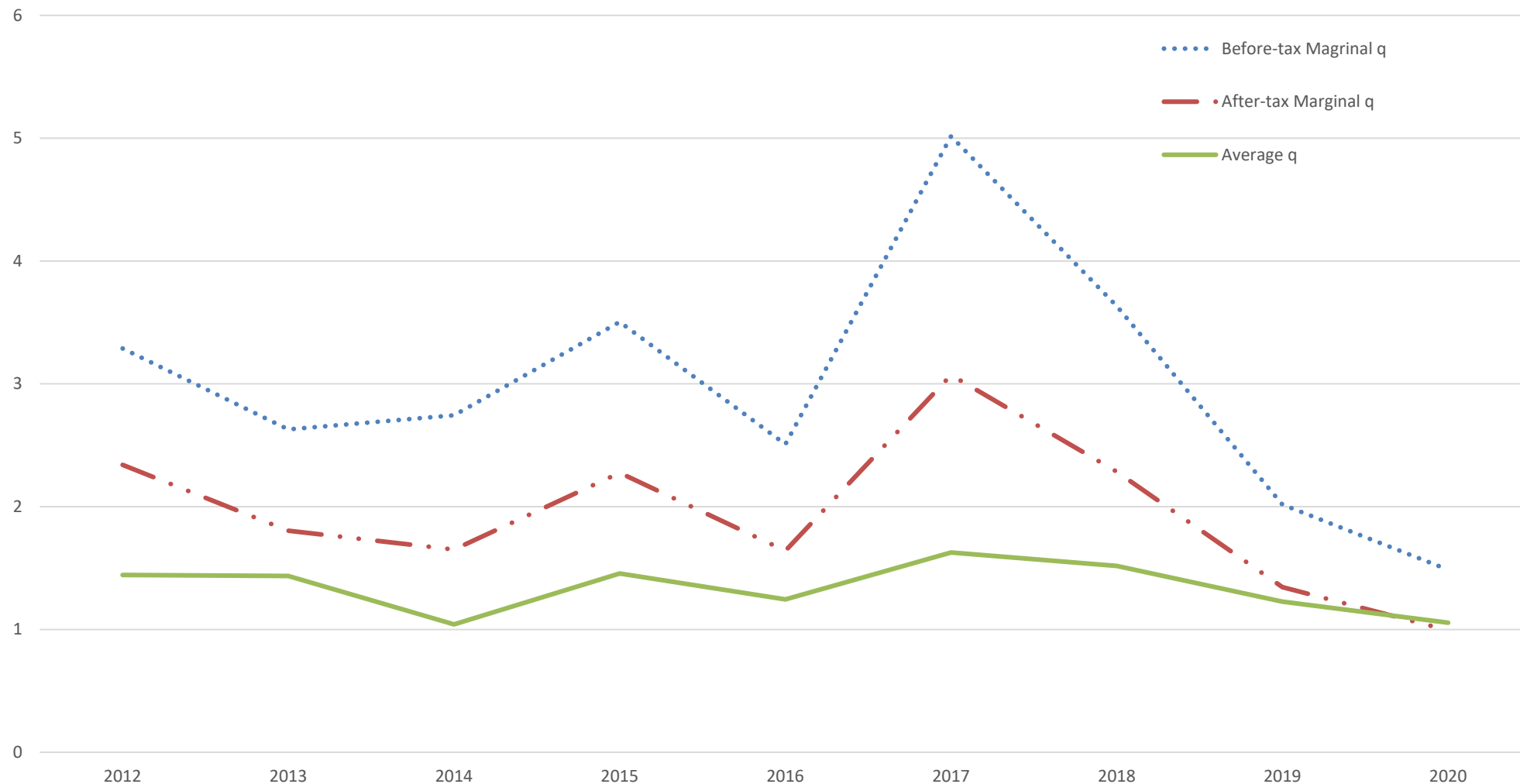
Source: Authors' estimations based on data from the balance sheet of China Aoyuan Property Group Limited.

Figure 9: Before-tax Marginal q , after-tax Marginal q , and Average q of Country Garden for the period 2007–2020.



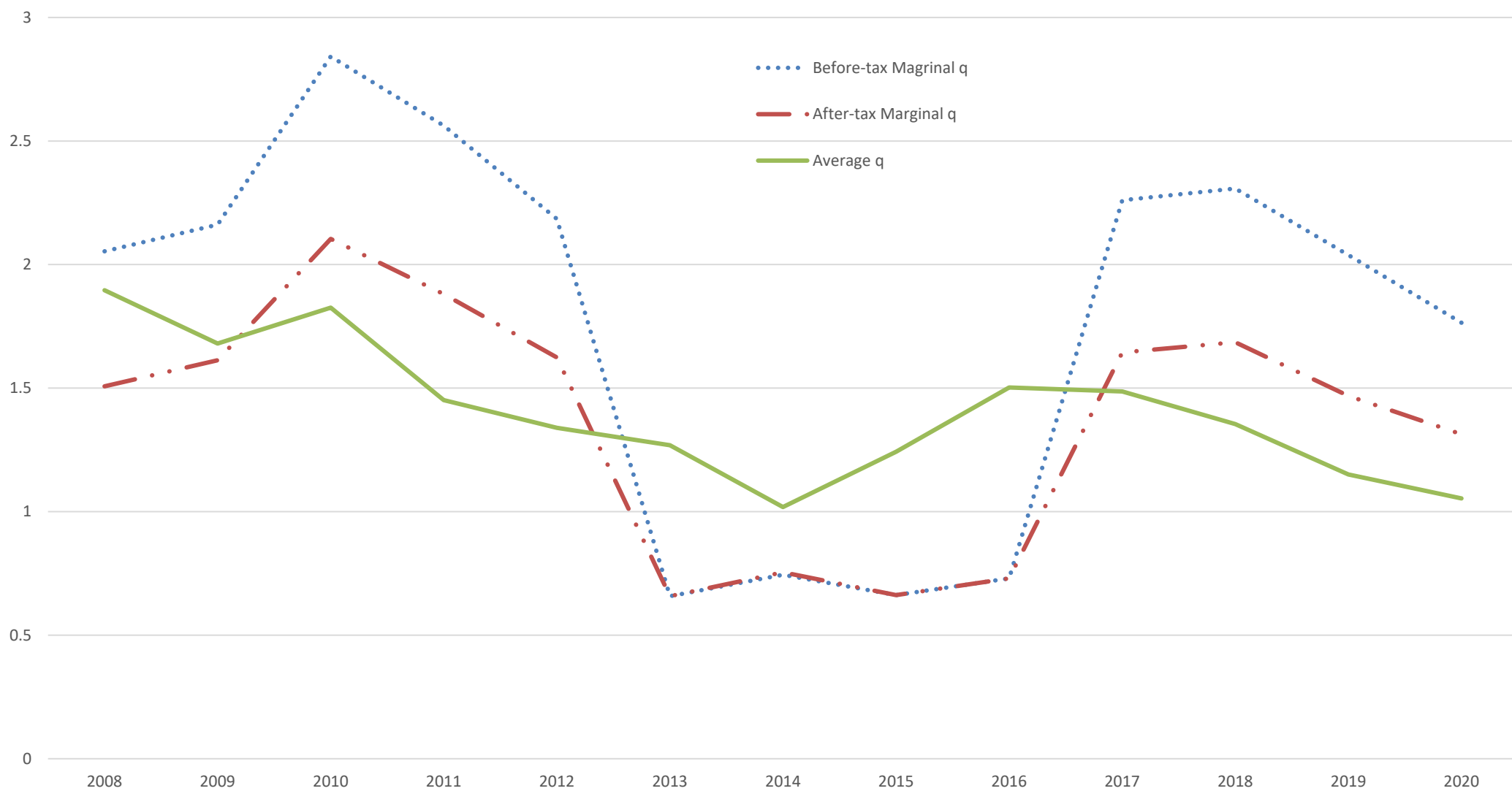
Source: Authors' estimations based on data from the balance sheet of Country Garden.

Figure 10: Before-tax Marginal q , after-tax Marginal q , and Average q of Cifi Group for the period 2012–2020.



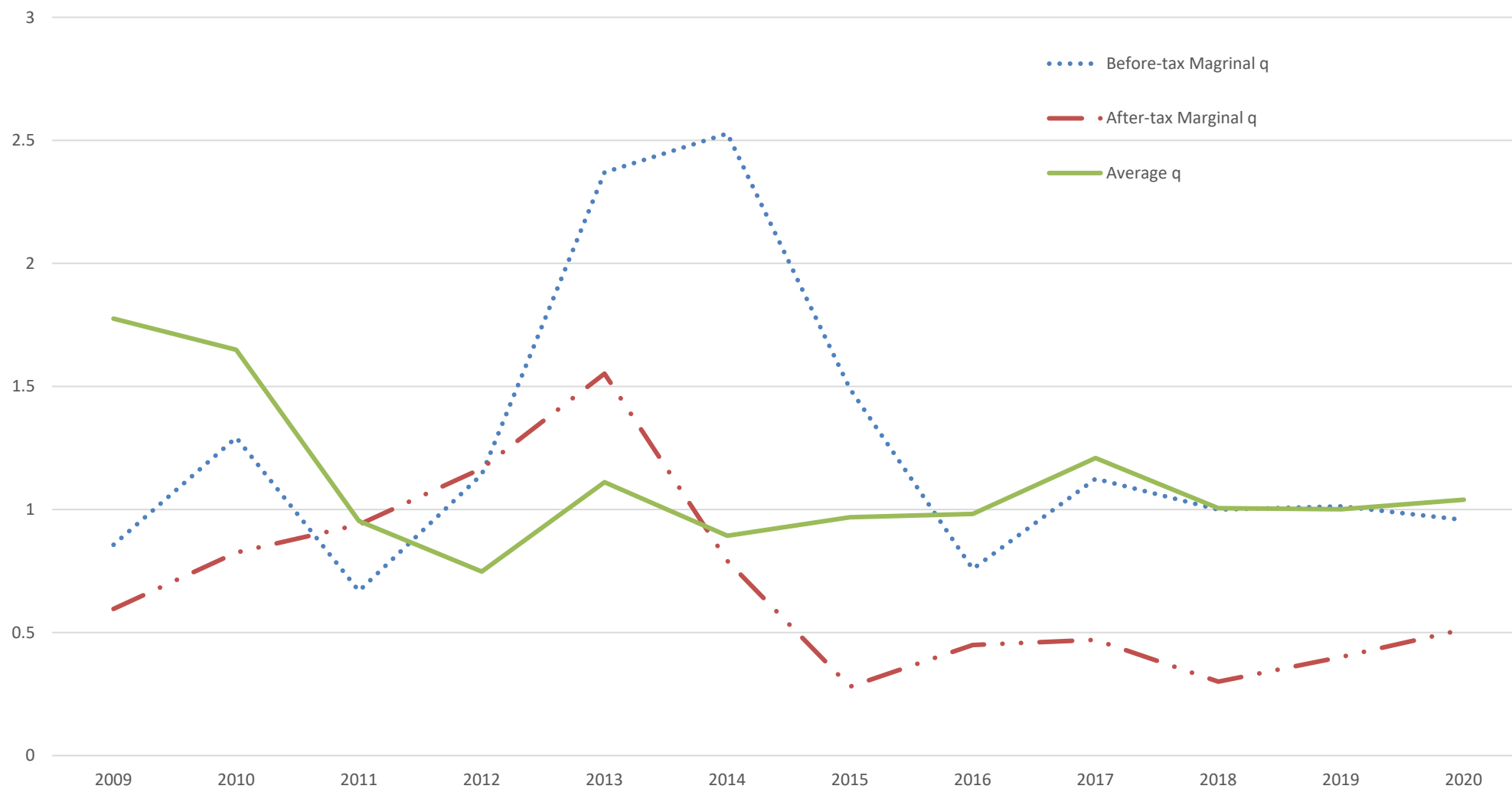
Source: Authors' estimations based on data from the balance sheet of Cifi Group.

Figure 11: Before-tax Marginal q , after-tax Marginal q , and Average q of China Vanke Co., Ltd. for the period 2008–2020.



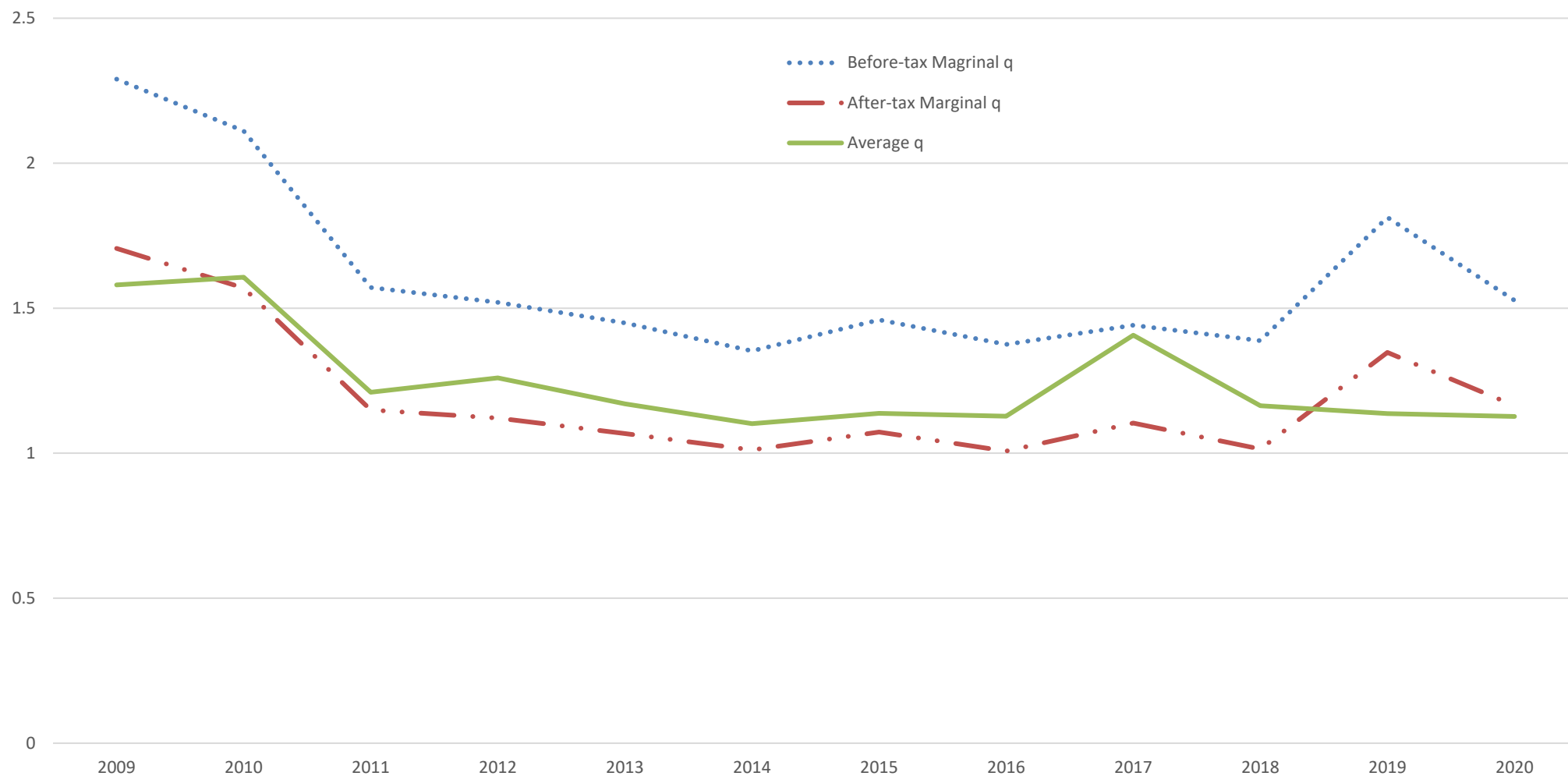
Source: Authors' estimations based on data from the balance sheet of China Vanke Co., Ltd.

Figure 12: Before-tax Marginal q , after-tax Marginal q , and Average q of Green Town for the period 2009–2020.



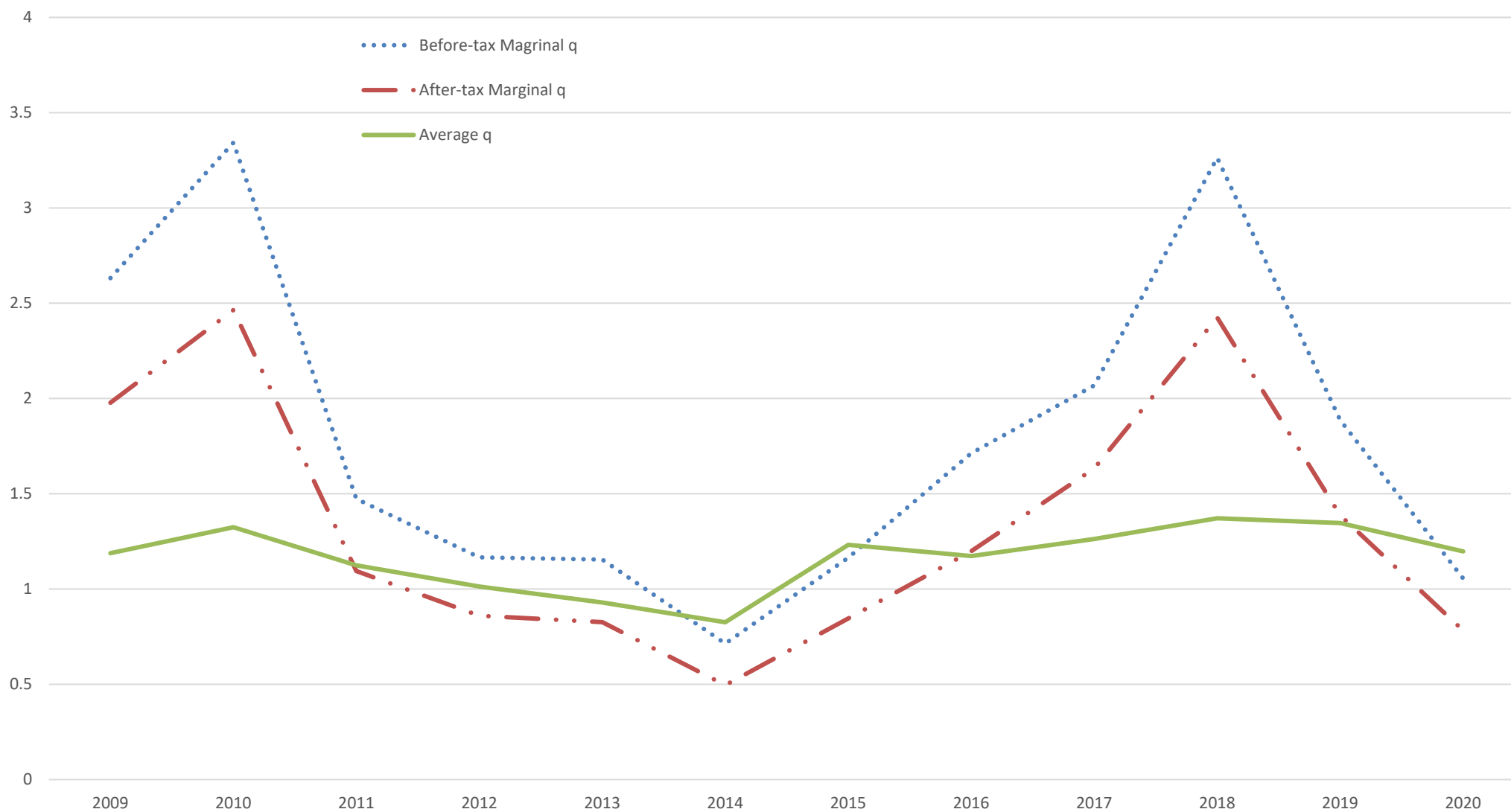
Source: Authors' estimations based on data from the balance sheet of Green Town.

Figure 13: Before-tax Marginal q , after-tax Marginal q , and Average q of Poly Development Holding Group Co., Ltd. for the period 2009–2020.



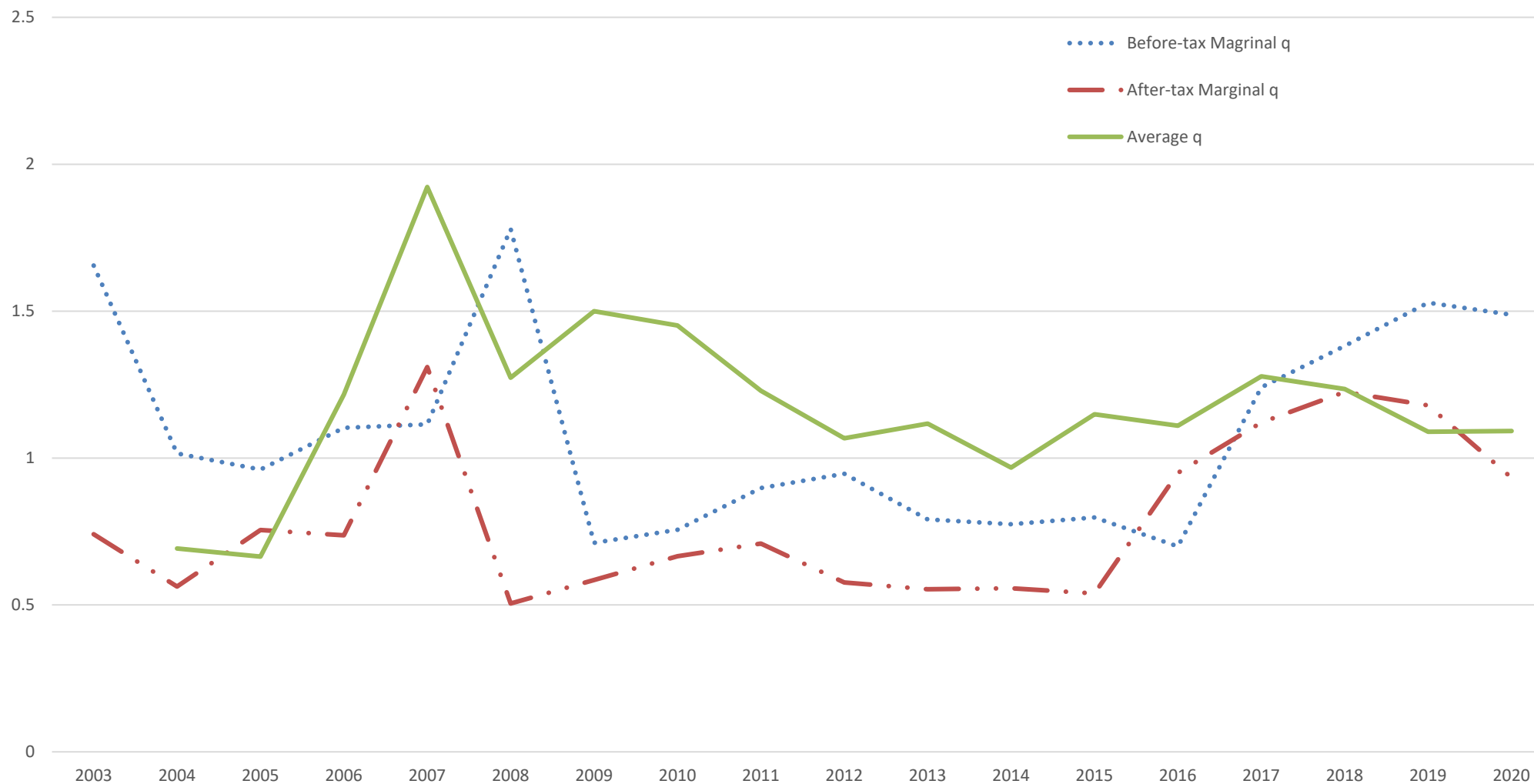
Source: Authors' estimations based on data from the balance sheet of Poly Development Holding Group Co., Ltd.

Figure 14: Before-tax Marginal q , after-tax Marginal q , and Average q of Hangzhou Binjiang Real Estate Group Co., Ltd. for the period 2009–2020.



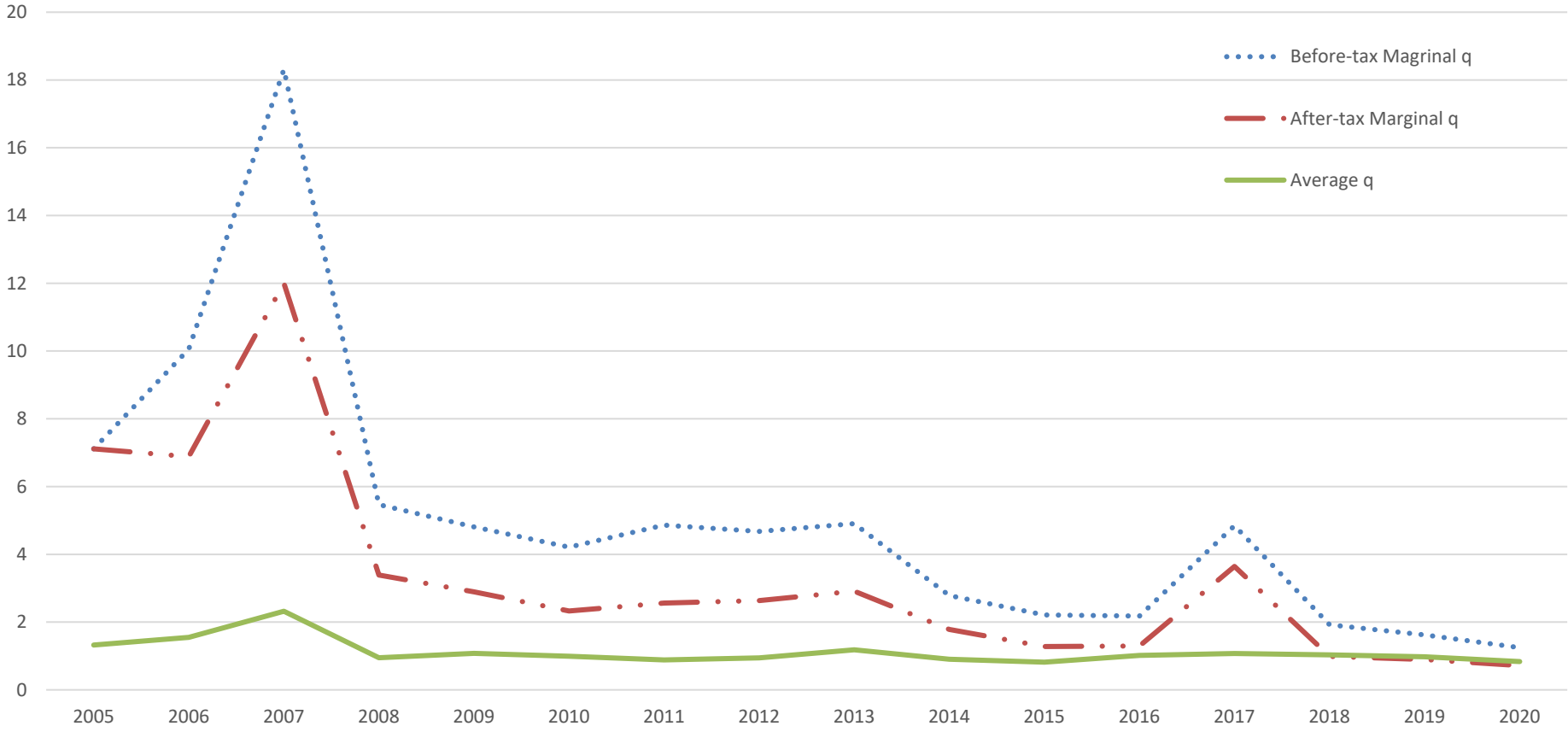
Source: Authors' estimations based on data from the balance sheet of Hangzhou Binjiang Real Estate Group Co., Ltd.

Figure 15: Before-tax Marginal q , after-tax Marginal q , and Average q of Gemdale Group for the period 2003–2020.



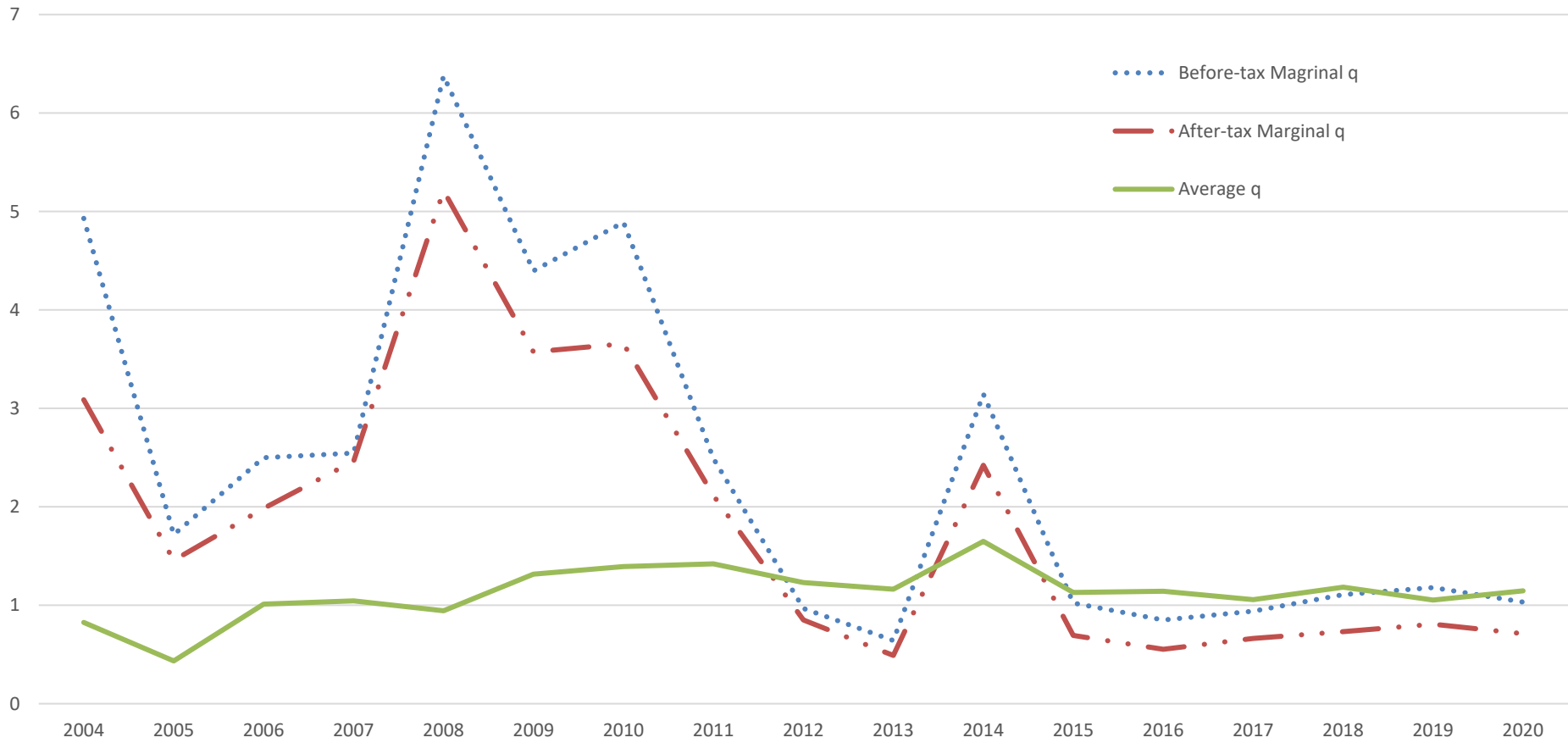
Source: Authors' estimations based on data from the balance sheet of Gemdale Group.

Figure 16: Before-tax Marginal q , after-tax Marginal q , and Average q of R&F Group for the period 2005–2020.



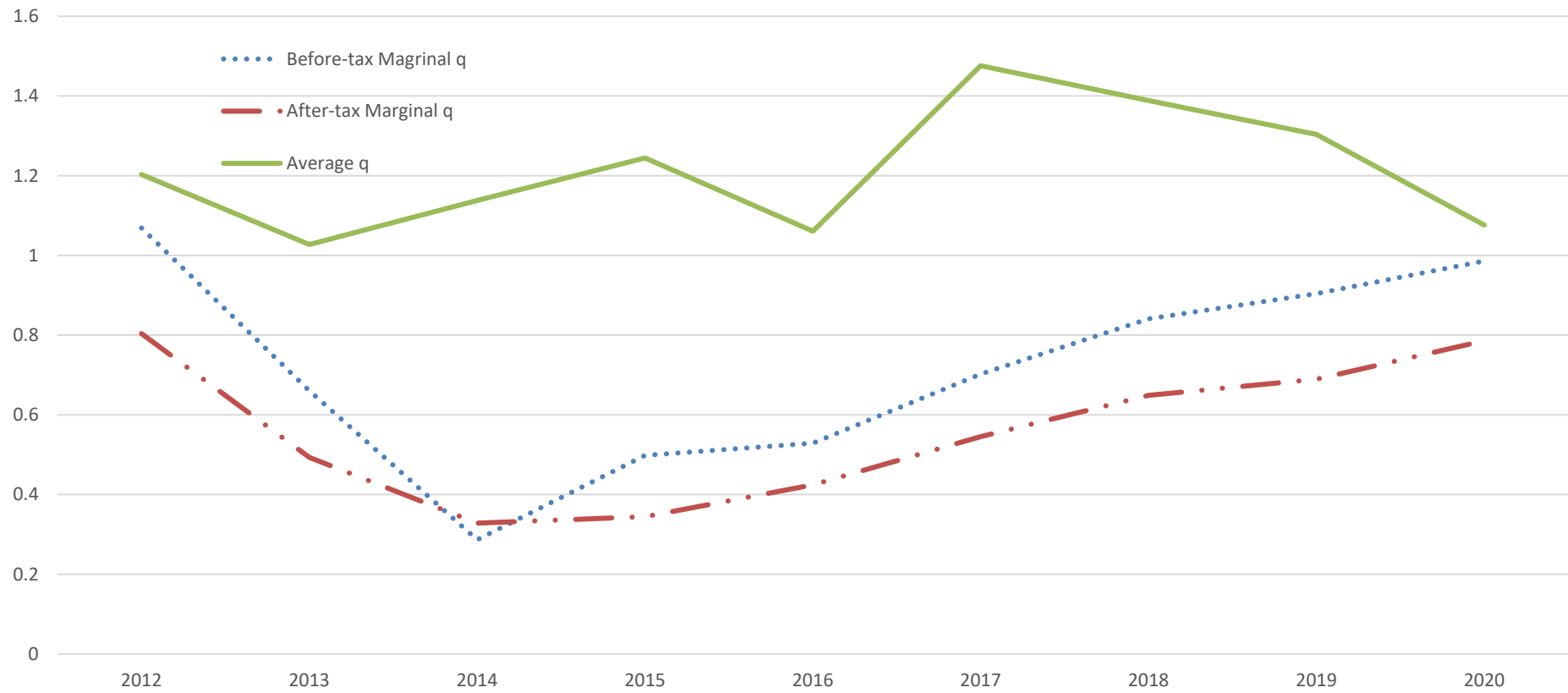
Source: Authors' estimations based on data from the balance sheet of R&F Group.

Figure 17: Before-tax Marginal q , after-tax Marginal q , and Average q of Green Land for the period 2004–2020.



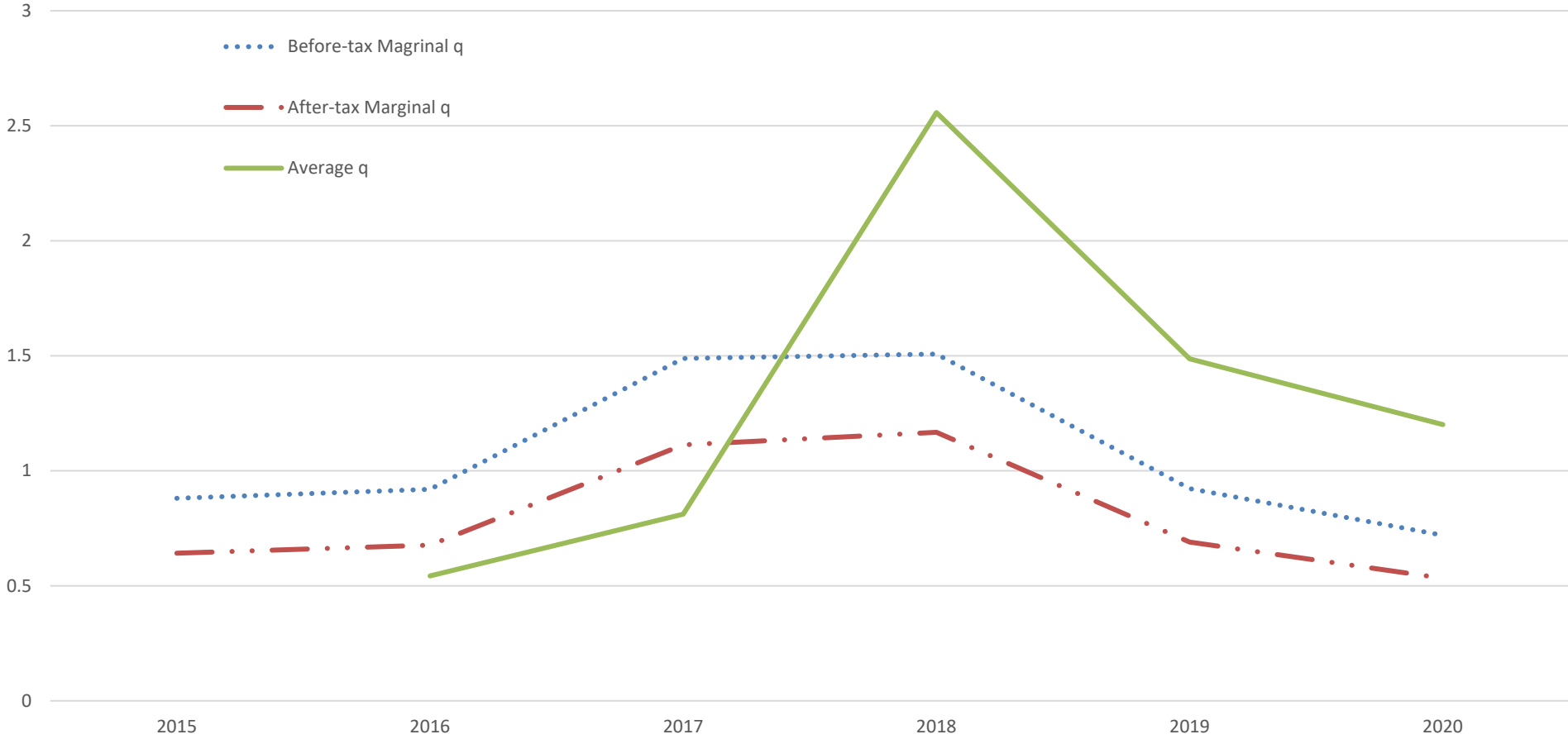
Source: Authors' estimations based on data from the balance sheet of Green Land.

Figure 18: Before-tax Marginal q , after-tax Marginal q , and Average q of Jinke Property Group Co., Ltd. for the period 2012–2020.



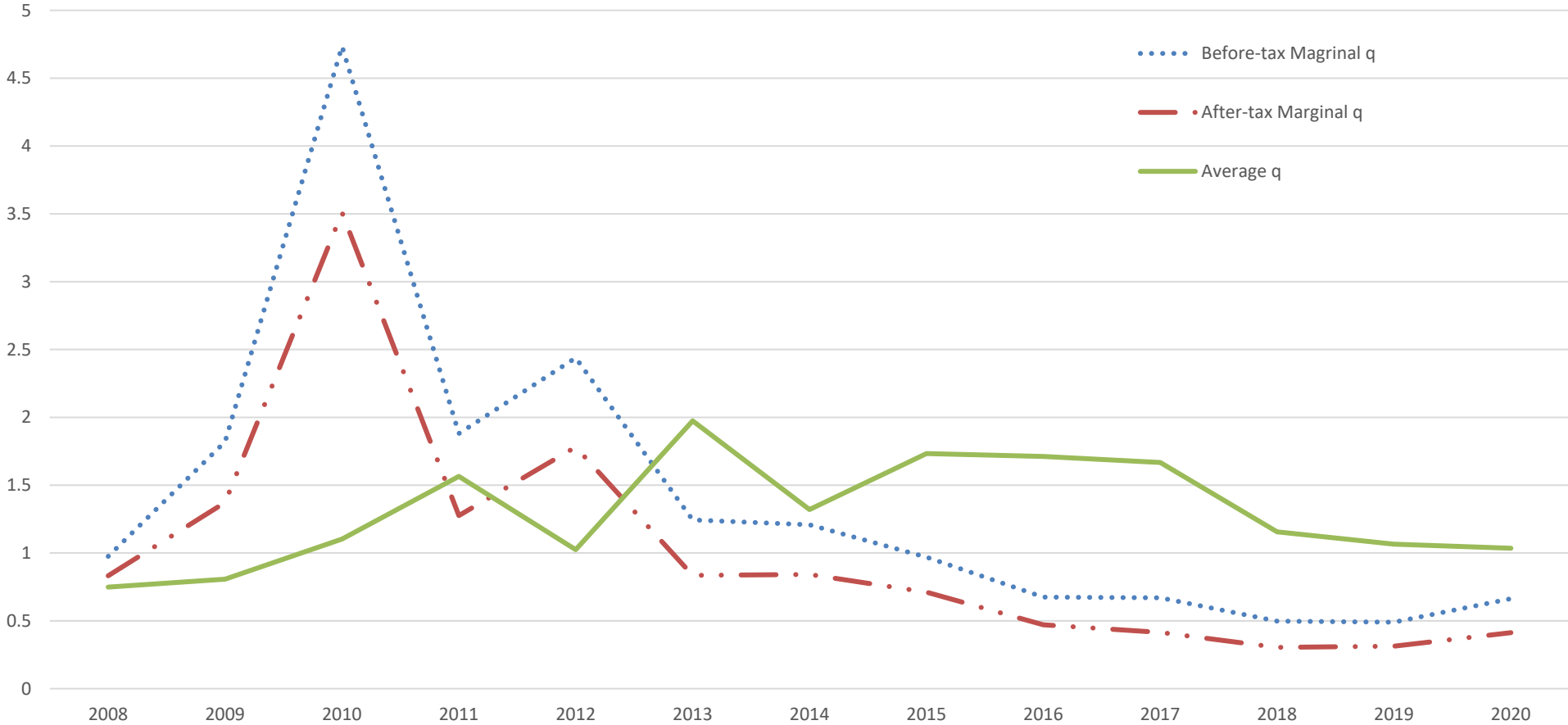
Source: Authors' estimations based on data from the balance sheet of Jinke Property Group Co., Ltd.

Figure 19: Before-tax Marginal q , after-tax Marginal q , and Average q of Seazen Holdings Co., Ltd. for the period 2015–2020.



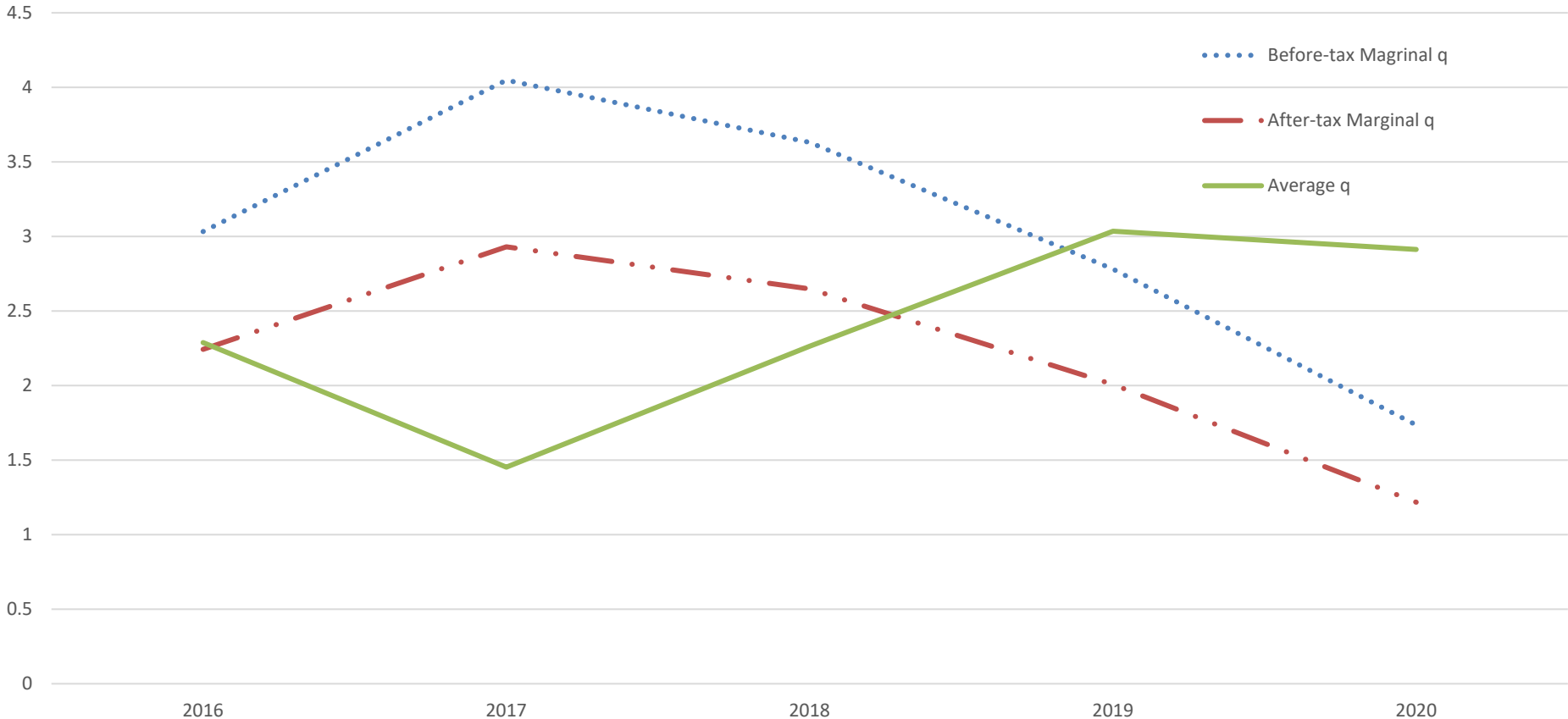
Source: Authors' estimations based on data from the balance sheet of Seazen Holdings Co., Ltd.

Figure 20: Before-tax Marginal q , after-tax Marginal q , and Average q of Yango Group for the period 2008–2020.



Source: Authors' estimations based on data from the balance sheet of Yango Group.

Figure 21: Before-tax Marginal q , after-tax Marginal q , and Average q of China Merchants Shekou Industrial Zone Holdings Co., Ltd. for the period 2016–2020.



Source: Authors' estimations based on data from the balance sheet of China Merchants Shekou Industrial Zone Holdings Co., Ltd.