DO CHINESE GOVERNMENT POLICIES AFFECT PERFORMANCE OF REAL ESTATE ENTERPRISES?

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Abstract. The Chinese central government has instituted a series of macro-economic tightening and easing policy measures on the real estate industry to stabilize the housing market in recent decades. However, our understanding of these policies and their impact on real estate firms is limited. This paper constructs an index of government policies on the real estate industry by collecting national housing policies in China from 2007 to 2019. We use this index to quantify the impact of government policies on real estate enterprises' performance, based on data from 103 real estate enterprises listed on the Chinese A-share market. Two important conclusions are drawn from the panel data regression. First, tightened real estate policies significantly lower real estate enterprises' profitability (ROA and ROE), while increase their liquidity risk. Second, the heterogeneity analysis shows that the tightened real estate policies yield downward impact more mildly on state-owned real estate enterprises than non-state-owned enterprises.

1. Introduction

The real estate industry has undergone rapid development since it was designated as a pillar industry of Chinese national economic development, and has been accompanied by rapidly increasing house prices. To curb the excessive rise and give full play to the role of real estate in driving the economy, Chinese central government has instituted a series of macro-control tightening and easing measures since 2003. In an overheating period of the real estate market, tightening actions are implemented to curb the rapid rise in housing prices, and in the housing recession period, easing actions are used to promote the development of the real estate market.

As the main actor of the real estate market, real estate enterprises have seen rapid growth in China as the real estate industry becomes a pillar industry. As of 2019, the number of Chinese real estate enterprises listed at home and abroad reached 210. Of these, 125 are listed in the Shanghai and Shenzhen stock exchanges, 83 are listed in the Hong Kong stock exchange and 2 are listed overseas. China has implemented increasingly strict control on its real estate market since 2016 (Guo et al., 2020; Hu, 2022). In 2020, Chinese government enacted a "three red lines" debt limit rule to regulate the leverage taken on by the developers, limiting their borrowing based on the following metrics: debt-to-cash, debt-to-equity, and debt-to-assets. The debt limit regulations led to difficulties of Evergrande Group and other Chinese property developers subsequently. In 2021, the contagion spread to other major property developer as Kaisa Group, Fantasia Holdings, Sinic Holdings, Modern Land, etc. It is interesting to observe that, the property developers which are facing severe financial difficulties are non-state-owned, while state-owned real estate companies are consistently in a good operating state, even in a tightening regulatory period. These facts suggest that real estate enterprises' performance is closely related to regulatory measures, especially tightening actions (Yu et al., 2017; Yang et al., 2018). Meanwhile, tightening housing policies yield downside impact on non-state-owned firms more severely than state-owned firms, which can be illustrated by the Chinese term "the state advances, the private sector retreats".

Chinese government has implemented various regulatory measures, including monetary, fiscal, macro-prudential, land, and administrative policy, all of which have stabilized housing prices through different procedures and directions (Hu, 2022; Deng et al., 2023). Even though real estate regulatory measures have been used intensively in recent years, our quantitative understanding of these

policies and their efficacy is limited. The method to evaluate these policies portfolio and their effect on real estate enterprise are not very clearly. Hence, this paper focuses on assessing real estate regulatory policies and quantifying their impact on real estate enterprises' performance. It hereby makes three contributions to the literature: First, it gathers a set of housing-related regulatory policies from 2006 to 2019 and constructs an intensity index to reflect their strictness. Second, it uses the intensity index to investigate the influence of real estate regulatory policies on the profitability and funding liquidity of real estate enterprises. Third, it examines the differential influence of real estate regulatory policies on state-owned and non-state-owned enterprises to determine their performance gap in tightening regulatory periods.

The paper is related to several strands of existing research. Our paper is connected to the literature assessing the effect of government policy on the real estate market. Most of existing literature focus on single policy versus the policy portfolio, which is focus of our research. For example, regulating Loan to value (LTV) ratio is a common policy tool. It has been used to control the residential mortgage loans (Morgan et al., 2019), to limit house price growth of certain regions (Hu, 2022; Deng et al., 2023). Caps on LTV and debt-to-income ratios create a countercyclical force on credit growth, and they are more useful to stabilize house price than other tools (Carreras et al., 2018). Song et al. (2014) find that real interest rates are significantly and positively related to real house prices, indicating that increases in the policy rate may not effectively depress real house prices. Shen et al. (2018) and Wang et al. (2019) show that land supply has negative effects on house prices from the demand-supply perspective, and that the government's effective and timely regulation of the real estate market is conducive to the stability of house prices. Purchase restriction is the most common measure among administrative means, and many researchers have studied its effect on house prices in China (Du & Zhang, 2015; Somerville et al., 2020). Some of these studies examine the effect of housing polices portfolio on real estate market. Yu et al. (2017) use binary variable represent the intensity of government policies portfolio: tightened policy = 1, otherwise 0. Hu (2022) investigates six different types of government policies, including monetary, macroprudential, fiscal and land policies, and identifies which type of policy has a greater influence on the dynamics of housing price. Deng et al. (2023) focus on the real estate tax, monetary policy and macro-prudential policy to study which policy or policy portfolio can be an effective long-run mechanism of house price regulation.

Amid a widely captured interest in the efficacy of government policies on the housing market, there has been a proliferation in the literature examining how the polices affect the house price rather than the real estate enterprises. Monetary and fiscal policies can control house price fluctuations (McDonald & Stokes, 2013; Guo et al., 2020; Gyourko & Krimmel, 2021). Land supply can affect the house price from the demand-supply perspective (Yu et al., 2017;

Shen et al., 2018), while the housing purchase restriction (HPR) policy which is regarded as the most effective tool stabilizes house price by controls on house transactions (Li et al., 2020b; Zheng et al., 2021). Confronted with policy shocks, the demand change in the real estate market may exert a substantial influence on the performance of real estate enterprises, as significant micro participants (Du & Zhang, 2015; Floetotto et al., 2016).

However, recent studies about the effect of government policies on the real estate enterprises are limited. Most of research focused on the effect of government policies on enterprises' financing cost and investment (Lemmon & Roberts, 2010; Yang et al., 2018; Li et al., 2020a). Gulen and Ion (2016) document a strong negative relationship between firm-level capital investment and the aggregate level of uncertainty associated with future policy. Yu et al. (2017) analyzed the influence of regulatory policies on the investment expenditures of real estate enterprises with data of Chinese listed real estate enterprises. Kang et al. (2021) find consistent evidence for a negative and non-monotonic impact of Macro-prudential policies on the level of firms' bank financing.

Our paper is also related to the differences in the performance of state-owned enterprises and non-state-owned enterprises affected by the housing policies. A supportive government firm relationship can help firms to acquire financing loan at a lower cost, and provide extra protections to overcome financial difficulties in downturn economic environment (Khwaja & Mian, 2005; Cerutti et al., 2017; Sun & Zou, 2021). In the credit market of China, policy-driven loan and commercial loan are two principal patterns (Bailey et al., 2011). Ling et al. (2016) find state-owned real estate firms are financed with more long-term bank loans than non-state-owned firms. Yu et al. (2017) pointed that state-owned enterprises, featuring with lower financing restriction and borrowing convenience of policy-based loan, suffer relatively lower policy shocks than private enterprises. Yang et al. (2018) concluded that real estate firms with political connections have better access to credit and loan extensions using the data of listed real estate firms in China.

Most existing studies focus on the impact of one single policy (land, monetary, fiscal, macro-prudential, administrative policy, etc.) on house prices and real estate enterprises. The literature has clearly not measured all housing policies, nor has it examined their combined impact on the performance of real estate enterprises. In fact, government prefers to use more than one policy to control the real estate market at one time, especially in the period of excessive rise of house price, and it is not comprehensive and accurate to study the impact of a single policy implementation. Moreover, China's government policies vary from year to year and regulatory intensity varies, simply using binary variable to represent intensity of regulatory policies cannot accurately assess government policies varying with time. Our paper thus makes a supplementary contribution to the scarce literature assessing real estate policies in China. First, this paper studies China's government policies portfolio over a single policy, and constructs an

intensity index to measure the strictness of the regulatory policies by creating a systematic database that includes all the housing policies that may affect real estate enterprises' performance. Second, it studies the effect of government policies on real estate enterprises' performance, and explain the China' 2020–2022 real estate crisis by examining the impact of government policies on real estate enterprises' profitability and liquidity risk. Moreover, to explain the reason for non-state-owned enterprisers' business difficulties in 2021, this paper further analyzes the differential influence of government policies on state-owned and non-state-owned real estate enterprises.

The remainder of the paper is organized as follows: Section 2 explains our real estate regulatory tools and the construction of the real estate regulatory intensity index. Section 3 illustrates the hypothesis development of this paper. Sections 4 and 5 present the empirical model and panel estimation results, including the results from several extensions. Section 6 concludes.

2. Real estate regulatory policy measures

This section describes our real estate policy tools database and the construction of our real estate regulatory intensity index. The use of real estate government policies over time is also reviewed.

2.1. Real estate regulatory policy tools

First, we build a database of real estate government tools covering 2006 to 2019 period. This paper focuses on five categories of housing regulatory tools, namely monetary, macro-prudential, fiscal, land and administrative policy, which are the main regulatory instruments of the Chinese central government.

Macro-prudential policy: The main prudential policy tools used by the Chinese central government to control the real estate market are mortgage rates, caps on the LTV ratio for mortgage loans, and capital requirements on real estate development projects (Rubio & Carrasco-Gallego, 2014; Morgan et al., 2019). Differentiated down payments and different mortgage rates have been implemented to contain the risk of mortgage loans since 2003. When contractionary monetary policies are implemented, policy makers usually stabilize house prices by raising the mortgage rates, caps on the LTV ratio, and capital requirements for real estate development projects. These measures significantly increase the financing cost of real estate enterprises while increasing the capital requirements on residents for the purchase of houses (Akinci & Olmstead-Rumsey, 2018; Carreras, 2018; Alam et al., 2019; Horra et al., 2021).

Fiscal policy: Central governments usually regulate the housing market through tax requirements for real estate development and transactions. Commonly used control tools are the property deed tax, land value increment tax, stamp tax on real estate transactions and business tax on real estate transactions (Du & Zhang, 2015; Kuttner & Shim, 2016; Deng et al., 2023). During tightened regu-

latory periods, policy-makers will restrict the transactions of the housing market by raising the property deed tax, land value increment tax, and stamp tax and extending the term exemption from business tax on real estate transactions (Deng et al., 2023). These measures largely reduce residents' demand for housing transactions.

Land policy: Major manifestations of the control policies in the land market include the following four aspects: (1) Controls on the supply of residential land: Increasing land supply for residential housing, affordable housing and rental housing to stabilize housing prices during a tightening period, while reducing or even suspending the land supply of residential houses during an easing period. (2) Controls on the land leasing stipulation: tightened policies such as "limited house price, competing for land price", "limited land price, competing for house price", and "existing house sales or competing for self-holding area after the premium rate exceeds the limit value" are often used to reduce the rate of house price increase (Shen et al., 2018; Zheng et al., 2023). (3) Requirements on the land leasing fee: During a tightening period, raising the land auction guarantee fund requirements and strictly checking the sources of land auction funds of real estate enterprises. (4) Crackdowns on land hoarding (Han et al., 2020). By 2003, the status of land regulation had been officially affirmed, and policies regulating the real estate market were implemented more frequently. Shen et al. (2018) list the chronology of regulatory policies for the land supply in China from 2003 to 2016 and find that the macro-control of land played a pivotal role in regulating the real estate market.

Administrative policy: Administrative policy refers to Chinese central government's establishment of mandatory administrative measures to directly regulate supply and demand in the real estate market (Floetotto et al., 2016; Akbari & Krystyniak, 2021). Frequent and diversified government intervention is an important feature of China's real estate market (Tian & Ma, 2009; Li et al., 2019). There are three main administrative control measures. The first is restrictions on house transactions, such as "purchase restrictions", "loan restrictions", "sale restrictions" and "price restrictions". The housing purchase restriction (HPR) policy is regarded as the most effective policy for stabilizing house prices (Zheng et al., 2021). Restrictions on purchases, loans, and sales lower the liquidity of the real estate market, while restrictions on prices compress the profits of real estate enterprises. The second measure is the supply regulation of affordable housing and rental housing. Policy-makers usually increase the amount of affordable housing and develop the rental housing market in tightening regulatory periods (Mak et al., 2007). The third measure is the supervision of the housing market. In tightening regulatory periods, governments strictly investigate the illegal entry of bank funds into the real estate market, the illegal operation of real estate agents and other acts that are not conducive to the stabilization of housing prices.

Monetary policies: In addition to these four types of housing regulatory policies, we also consider two monetary measures, namely bank requirement reserve ratios and loan interest rates. These two indicators are not housing policies, but they have a vital influence on the capital flow to the real estate market. The changes in the loan interest rate affect the financing costs of real estate compa-

nies, and the adjustments of the bank reserve ratio (RRR) indirectly affect the amount of funds flowing into the real estate market (Almeida & Campello, 2007; Song et al., 2014; Guo et al., 2020). Therefore, they are included in the construction of the real estate policies intensity index.

The government policies on Chinese real estate market from 2006 to 2019 are listed in Table 1.

Table 1. Chronology of government policies on the real estate market in China from 2006 to 2019 (source: compiled by the authors from various central government and ministry websites sources)

Time	Non-housing measures (monetary policy)	Housing-measures (macro-prudential, fiscal, land and administrative policy)
2006	(1) Raised benchmark loan rates twice (2) Raised RRR 3 times	(1) Raised the down payment ratio of residential mortgage loan to 30% (2) Extended the Term extension of sales tax exemption from 2 years to 5 years (3) Improved requirements of bank loan for real estate enterprise
2007	(1) Raised benchmark loan rates 6 times (2) Raised RRR 10 times	(1) Increased the down payment ratio of the second suite to 40% (2) Raised the residential mortgage interest rate to 1.1 times of the benchmark loan rate for the same period
2008	(1) Lowered the one-year loan interest rate 5 times (2) Raised RRR 7 times, lowered it 3 times	(1) Lowered the floor of residential mortgage interest rate (2) Lowered the down payment ratio for residential mortgage loan (3) Downward adjustment of the deed tax (4) Stamp duty and land value-added tax exemption (5) Shortened the term of business tax exemption from 5 years to 2 years
2009	No change	(1) Expanded the financing channels of real estate enterprises (2) Lowered the minimum ratio of capital requirement on real estate developers from 35% to 20% (3) Increased the supply of residential house
2010	(1) Raised the benchmark loan rate twice (2) Raised the RRR 6 times	(1) Raised the minimum down payment ratio for residents' second mortgage loans to 40% (2) Raised the minimum down payment ratio for residents' first mortgage loan to 30%, and raised the minimum down payment ratio for residents' second mortgage loans to 50%, with the mortgage interest rate being 1.1 times of the benchmark loan rate (3) Raised the housing transaction tax (4) Improved land supply efficiency (5) Explored varied modes of land transfer to curb the unreasonable increase in land prices (6) Implemented "purchase restrictions"
2011	(1) Raised the benchmark loan rate 3 times (2) Raised the RRR 6 times, and lowered it twice	(1) Implemented property tax in pilot cities (2) Expanded "purchase restrictions" to more cities (3) New land auction stipulation: limited house price and competition for land prices
2012	(1) Lowered the benchmark loan rate 2 twice (2) Lowered the RRR twice	Cracked down on real estate speculation to stabilize the housing market
2013	No change	(1) Implemented a policy of home purchase restrictions (2) Increased the supply of residential land (3) Increased the supply of affordable housing
2014	Lowered the benchmark loan rate once	(1) The minimum down payment ratio for residents' second mortgage loans can be lowered to 30% if the first home loan has been settled (2) Lowered the residents' second mortgage loans rate to 0.7 times of benchmark loan rate
2015	(1) Lowered the benchmark loan rate 5 times (2) Lowered the RRR 4 times	(1) Lowered the down payment ratio for residents' second mortgage loans (2) Shortened the term of business tax exemption from 5 years to 2 years (3) Reduced the minimum ratio of capital requirement on real estate developer from 30% to 25% (4) Cancelled "home purchase restrictions" (5) Reduced excess inventory in real estate
2016	Lowered the RRR once	(1) Lowered the down payment ratio for residential mortgage loan (2) Lowered the property deed tax and business tax (3) Extended "reducing excess inventory of residential houses" to more cities (4) Purchase restrictions and mortgage loan restrictions

Time	Non-housing measures (monetary policy)	Housing-measures (macro-prudential, fiscal, land and administrative policy)
2017	No change	(1) Developed the rental housing market in pilot cities to curb the rise in house price (2) Increased the supply of affordable housing
2018	Lowered the RRR 3 times	(1) Implemented "houses are for living in and not for speculative investment" to curb the rise in house price (2) Crackdown on real estate speculation and "illegal real estate agents", as well as on illegal activities and false real estate advertising by real estate enterprises (3) Established a long-term regulatory mechanism to stabilize the housing market
2019	Lowered the RRR 3 times	(1) Restricted real estate enterprises from issuing foreign debts (2) Crackdown on the illegal inflows of funds from banks into real estate

2.2. Construction of real estate regulatory policy index

Akinci and Olmstead-Rumsey (2018) constructed a novel index of macro-prudential policies to access the effectiveness of these policies in curing credit growth and house price appreciation. Yu et al. (2017) used binary variable to access China's government housing policies. This paper constructs aggregate indexes of China's government housing policies by referring to the index construction method of Akinci and Olmstead-Rumsey (2018). The first step is constructing the housing index of regulatory actions based on the four housing-related tools. First, for each of the four housing policy measures, i.e. macro-prudential, fiscal, land and administrative policy, we create a yearly dummy variable assigned a value of 1 if the measure was introduced to damp house price growth and a value of −1 if the measure loosened restrictions. If no action was taken in a given year, we assign the variable a value of zero. According to Carreras et al. (2018) and Deng et al. (2023), if the caps on LTV is raised or the mortgage interest rate is downward, the variable is assigned −1, and vice versa, it is assigned 1. If the housing transaction tax, deed tax, or property tax is downward, the variable is assigned −1 (Du & Zhang, 2015; Kuttner & Shim, 2016; Deng et al., 2023). If the land supply of affordable house is increased, or restrictions on land action is improved, the variable is assigned 1 (Yu, et al., 2017; Shen et al., 2018). If administrative measures such as restrictions on house transactions

are implemented, or increased affordable house supply, or supervision of housing market, are implemented, the variable is assigned 1, and vice versa, it is assigned −1 (Du & Zhang, 2015; Floetotto et al., 2016; Somerville et al., 2020).

While we typically know the implementation for each regulatory action, we aggregate the individual measures to an annual frequency. If a tool was used more than once in a year, we sum all changes over the year. As stated in Akinci and Olmstead-Rumsey (2018), ideally we should measure the intensity of real estate control policies. For example, for LTV caps we would like to use the actual changes to the percentage requirement, but different borrowers face different LTV caps based on where the property is located and whether it is the borrower's first or second home. It is thus hard to record the overall LTV cap across the country. The same issue applies to many other types of housing-related policies, such as the measures of land policy and administrative means. Thus we choose to use an indicator variable to quantify the changes to government policies instead.

As we presented in the previous section, changes to the monetary policy rates and to the reserve requirements on domestic currency deposits (RRR) also affect the housing market and the performance of real estate enterprises (Kuttner & Shim, 2016). Therefore, the second step of the real estate regulatory index construction is including the changes in the monetary policy rate and reserve requirements. Since policy rate and reserve requirement are
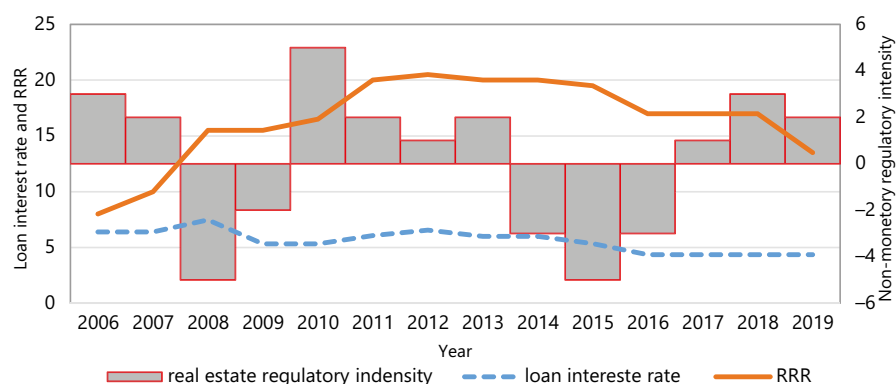

Figure 1. Total incidence from 2006 to 2019 of the real estate regulatory tools

nationally uniform, we use their actual changes to the percentage requirement. The yearly change of the monetary policy rates is calculated as the one-year loan rate at the end of this year minus the one-year loan rate at the end of last year. The yearly change of the RRR is calculated by the yearly difference of the RRR values. Moreover, the data on the monetary policy rate changes and changes to the RRR are multiplied by 100 to remain with the magnitude of housing index data.

Once we construct the cumulative indicators variables for the individual housing control measures and changes in the monetary policies rate and reserve requirements, we create cumulative indexes of housing and non-housing measures, as well as a cumulative index for all real estate government policy measures (hereafter referred to as the REGP index).

We use yearly changes in our analysis rather than the cumulative indexes because the changes in the real estate regulatory index can accurately show the density of regulatory policy. Figure 1 shows the total incidence from 2006 to 2019 of the real estate regulatory tools examined here to illustrate their usage.

2.3. Evaluations of REGP index

To examine the REGP index constructed in this paper, we compare it with GDP growth and the National Real Estate Climate index, which is compiled by the National Bureau of Statistics. The Real Estate Climate index comprises a comprehensive set of indicators for real estate investment, capital, area, and sales. It measures the degree of prosperity of China's real estate market (Jiang et al., 2022; Chen et al., 2023). The real estate industry plays a pivotal role in Chinese economic growth. Real estate and construction sector contributes to around 14% of the total GDP in 2021.

Due to the wealth effect, real estate boom, generally encourage consumer spending and lead to higher economic growth. However, when the house prices are rising rapidly, Chinese central government tends to implement tightened real estate policies to stabilize housing market (Deng et al., 2023). For example, in 2010, Chinese State Council issued a series of policies and regulations designed to cool off the property markets (State Council Document Number 10), and in 2016, Chinese central government employed differentiated housing credit policies to curb the soaring house prices (Hu, 2022; Deng et al., 2023). Therefore, GDP, the Real Estate Climate index and REGP index are expected to be positively correlated. This is consistent with the correlations in Table 2.

Table 2. Correlations between REGP index and other policy measures

	REGP index	Climate index	GDP
REGP index	1		
Climate index	0.7811	1	
GDP	0.6736	0.6917	1

We also compare the REGP index with monetary policy and macro-prudential policy. M2 is used as an indicator of monetary policy, and bank loans of real estate enterprises are used as an indicator of macro-prudential policy. These two indicators reflect the easing of policy. While the REGP index is the intensity of tightened policies, REGP and M2, REGP and bank loans are expected to be negatively correlated. Indeed, the correlation of REGP and M2 is –0.3008, and the correlation of REGP and bank loans is –0.2883.

3. Hypothesis development

Real estate enterprises are capital-intensive, and high-leverage and have a high capital turnover (Yu et al., 2017). In this paper, we use two important indicators: profitability and funding liquidity, to measure the performance of real estate enterprises.

Chinese central government implement policies to stabilize house prices mainly through regulating the supply and demand in the housing market. On the one hand, policies on the demand side control the demand of homebuyers by adjusting the housing credit policy, purchase and sales restrictions, taxation and other measures. On the other hand, policies on the supply side mainly include regulating the scale of the land supply, low-income housing and rental housing supply, and the financing requirements of real estate enterprises.

To understand impacts of government policies on the real estate enterprises, we analyze three channels. First is the cost channel, tightened government policy increases the cost of enterprises. (1) Tightened monetary policy with higher policy rate increases the financing cost of enterprises. (2) Bank loan is the main funding source for Chinese real estate developers. Tightened macro-prudential measures, for example, restrictions on developer borrowing and credit growth limit make it more difficult for real estate developers to obtain bank loan, and alternative financing channels are usually at higher funding cost (Yang et al., 2018; Deng et al., 2023). (3) Strict land supply policy leads to the fierce competition among developers and land purchases with higher cost (Zheng et al., 2021).

The second is through the sales and distribution channel. Tightened housing policies lead to a drop in demand for new house purchases. (1) Among macro-prudential tools, a LTV policy is applied to constrain mortgage loan creation, and tightening of LTV caps requires higher down payment to obtain mortgages (Morgan et al., 2019). Meanwhile, raising the mortgage rates increases the cost of buying a house. (2) Tightened fiscal policy may increase transactions costs by raising the deed tax and transaction tax. (3) The government restricts new house transactions by the home-purchase limit (Du & Zhang, 2015).

The third is the collateral/asset value channel. The housing boom can increase collateral value, which may help firms relax their financial constraints and obtain more bank loans for investment or innovation (Schmalz et al., 2017). Strong sales during housing boom lead enterprises

to reinvest their cash flows into new projects. Enterprises tend to step up land acquisitions and expansion plans by acquiring project companies and smaller developers. The aggressive expansion hurt profitability and cash flow of enterprises, and any fall in property price caused by the tightened measures could lead real estate enterprises into liquidity crisis and severe financial difficulties.

Therefore, we state the following two hypotheses.

Hypothesis 1: Tightened real estate government policies will reduce the profitability of real estate enterprises.

Hypothesis 2: Tightened real estate government policies will increase real estate enterprises' asset-liability ratio and increase their liquidity risk.

There are two main differences in the impact of tightened policies on state-owned and non-state-owned enterprises. First, due to the close relationship between state-owned real estate enterprises and the government, when governments implement tightened policies, state-owned enterprises are inclined to cooperate with governments to cool down the housing market. Compared with the aggressive expansion of non-state-owned enterprises, they are conservative to step up land acquisitions and expansion plans. Therefore, the tightened policies have less effect on their asset-liability ratio and liquidity.

Second, compared with private enterprises, state-owned enterprises, facing lower financing restrictions and the borrowing convenience offered by policy-based loans, suffer relatively lower policy shocks (Ling et al., 2016; Yang et al., 2018). In other words, state-owned real estate companies have easier access to bank loans and lower financing costs than non-state-owned real estate companies. Accordingly, we develop and test the following hypothesis.

Hypothesis 3: Tightened real estate policies have less influence on the liquidity of state-owned real estate enterprises than non-state-owned enterprises.

4. Data and methods

4.1. Data description

Regarding the study data, considering the availability, this paper uses the data sample of Chinese listed real estate enterprises, including all listed A-shares real estate enterprises on the Shanghai and Shenzhen Stock Exchanges. We retrieve our sample from the CSMAR (China Stock Market Accounting Research) database. China revised the Chinese Generally Accepted Accounting Principles (GAAP) to embrace the International Financial Reporting Standards from 2007, and the asset-based variables and earning-based variables are not comparable before and after this reform. Therefore, the data sample range is from 2007 to 2019. According to the latest classification standard issued by China Securities Regulatory Commission, there are 133 listed real estate enterprises. We rule out companies listed after 2007 and those whose main business is not real estate development. Due to the data scarcity of some variables and our practice of excluding potential outliers, the dataset for our regression analysis covers 103 firms with 1,339 firm-year observations.

Dependent variable: The performance of real estate enterprises. Our dependent variable is the profitability and funding liquidity of real estate enterprises. The profitability is measured by return on assets (ROA) and return on equity (ROE), and liquidity is measured by the asset-liability ratio (Lev) and the quick ratio (Qr). Table 3 presents a detailed description of all the variables in this paper.

Table 3. Variable description

Variable	Description
ROA	Operating return on assets, which is the ratio of EBIT to assets
ROE	The ratio of net profits to equity
Lev	Ratio of total liability to total assets
Qr	Quick ratio: (Cash + marketable securities + receivables)/current liabilities
REGP	Real estate regulatory intensity index
b	Dummy variable equaling 1 if the firm is state-owned, and 0 otherwise
numem	A firm's number of employee. Lnnumem: natural logarithm of numem
Tagrowth	Total asset growth: the difference in total assets between year t and year t-1 divided by total assets in year t-1
Icgrowth	Operating income growth: a variable measured as the difference in operating income between year t and year t-1 divided by operating income in year t-1
Cfo	Operating net cash flow: the ratio of operating net cash flow to total assets
Tator	Total asset turnover: the ratio of sales to total assets
ebits	Earnings before interest and tax. Lnebits: natural logarithm of ebits
M2	Money supply that includes cash, checking deposits, and other types of deposits. LnM2: natural logarithm of M2. Source: China Statistical Yearbooks
BankLoan	Total amount of new bank loans of real estate enterprises. LnBankloan: natural logarithm of Bankloan. Source: China Statistical Yearbooks
Price-to-income	House price to per capital urban disposable income ratio. Source: CREIS
Urbanization	The annual increase rate of urbanization degree. Source: China Statistical Yearbooks

Independent variable: REGP index. Our key independent variable is the intensity of real estate regulatory tightening, which is an index variable presented in Section 2.2. We use the dummy variable b to indicate the ownership of a real estate enterprise: b equals one if the real estate enterprise is state-owned, and zero otherwise.

Control variables: To avoid the omission of those variables that may be correlated with firm performance, it is necessary to control for them in the regressions. Following the standard specification in the literature, we firstly establish a variety of firm characteristics that can affect

Table 4. Descriptive statistics of variables

	N	Mean	Standard error	Min	Max
ROA	1330	0.026	0.042	−0.154	0.150
ROE	1313	0.074	0.127	−0.627	0.346
Lev	1339	0.639	0.213	0.119	1.541
Qr	1334	0.755	0.822	0.075	5.416
REGP	1339	0.004	0.427	−0.885	0.758
ebits	1238	1.277e+09	2.915e+09	−3.196e+08	2.101e+10
numem	1330	2962	7797	9	131505
Icgrowth	1321	0.504	1.932	−0.901	14.154
Tagrowth	1334	0.156	0.275	−0.435	1.296
Tator	1324	0.271	0.174	0.009	0.969
Cfo	1192	0.004	0.111	−0.321	0.327
M2	1339	1.140e+06	502400	403442	1.986e+06
BankLoan	1339	17202	6214	7016	25242
Price-to-income	1339	7.569	0.503	6.780	8.800
Urbanization	1339	0.024	0.006	0.017	0.040
b	1339	0.478	0.500	0.000	1.000

firms' performance (Meng et al., 2011; Chen et al., 2021; Kang et al., 2021), specifically, the control variables used in our analysis include firm size, growth rate of total assets, growth rate of operating income, operating cash flow and turnover rate of total assets. Firm size is measured by the natural logarithm of employee numbers. The total asset growth rate reflects an enterprise's growth, the asset-liability ratio reflects an enterprise's capital structure, the net cash flow generated form business activities accounts for the proportion of total assets to reflect the liquidity of an enterprise, and the operating cost rate reflects an enterprise's ability to control the costs. Total asset turnover reflects the operating capacity of an enterprise's overall assets. Next, we add a macroeconomic variable, house price to per capital urban disposable income ratio (price-to-income), in our regression to control the impact of real estate market risk on firms' performance.

Table 4 reports the summary statistics for all the variables used in this paper. The observation unit is a firm-year. On average, a listed real estate enterprise has an ROA of 2.64%, an ROE of 7.39%, an asset-leverage of 63.90%, a quick ratio of 0.7550, an operating income growth rate of 0.5043, total asset growth rate of 0.1559, and total assets turnover of 0.2709. The minimum of ROA is −62.67%, and the maximum of ROA is 34.57%. Asset-liability ratio ranges from 11.86% to 154.05%, and quick ratio ranges from 0.0753 to 5.4156, indicating there are large differences in profitability, asset-liability ratio and the quick ratio among the listed real estate enterprises. These features are similar to the results of other research on listed real estate firms in China. In order to rule out the effects of outliers, all the variables are winsorized at the 99% level.

Table 5 presents the results of the collinearity test among the variables. The VIF of each variable is far smaller than 1, which illustrates that there is no collinearity among the variables.

Table 5. Results of collinearity

Variable	VIF	1/VIF
Lnnumem	1.07	0.932526
Icgrowth	1.05	0.954514
Tagrowth	1.06	0.947545
Tator	1.11	0.904664
REGP	1.05	0.950728
Price-to-income	1.02	0.981085

4.2. Econometric model

We first choose the econometric model between the fixed-effects model and mixed-effects model by the *F* test. The results of the *F* test support the fixed-effects model. Then, Hausman test is done to choose the better one between a random-effects model and a fixed-effects model. The null hypothesis is to support for a random-effects model, and the alternative hypothesis is support for a fixed-effects model. Table 6 displays the results of the Hausman test. The *P*-values of models 1, 2, 3, and 4 are less than 0.05, leading to the rejection of the null hypothesis at the 5% significance level. Therefore, the panel fixed-effects model is suitable for the econometric model of this paper.

The profitability of real estate enterprises is measured by operating return on assets (ROA) and operating return on equity (ROE) as the dependent variables. The

Table 6. Hausman test of models

	ROA	ROE	Lev	Qr
Model	61.62***	42.86***	22.09**	38.60***
P-value	0.0000	0.0000	0.0365	0.0001

Notes: ***, and ** denote variables that are statistically significant at the 1%, and 5% levels, respectively.

independent variable is the real estate regulatory intensity index. We construct the following two fixed-effects regression models to test the effect of real estate regulatory intensity on the profitability of real estate enterprises:

$$ROA_{it} = \alpha + \beta_1 REGP_{it} + \delta X_{it} + firm_t + \varepsilon_{it} \; ; \qquad (1)$$

$$ROE_{it} = \alpha + \beta_1 REGP_{it} + \delta X_{it} + firm_t + \varepsilon_{it} \; . \qquad (2)$$

The liquidity of real estate enterprises is measured by asset-liability ratio (Lev) and the quick ratio (Qr). To test the effect of real estate regulatory intensity on firms' funding liquidity, the econometric models are constructed as follows:

$$Lev_{it} = \alpha + \beta_1 REGP_{it} + \delta X_{it} + firm_t + \varepsilon_{it} \; ; \qquad (3)$$

$$Qr_{it} = \alpha + \beta_1 REGP_{it} + \delta X_{it} + firm_t + \varepsilon_{it} \; . \qquad (4)$$

In models (1)–(4), t indicates year. The independent variable REGP is the index of real estate regulatory intensity. Control variables X include firm size (*Lnnumem*), total asset growth (*Tagrowth*), operating income growth (*Icgrowth*), total asset turnover (*Tator*), and house price to per capital urban disposable income ratio (*Price-to-income*).

5. Empirical results

5.1. Benchmark regression

To test the influence of real estate regulatory policies on the profitability and funding liquidity of real estate enterprises, we run the benchmark regression with the full sample. Table 7 reports the estimation results based on models (1)–(4).

Column (1) shows that the intensity of real estate tightened policy is significantly and negatively related with ROA

of real estate enterprises at the 1% level, and column (2) shows that the intensity of tightened real estate policy has a significantly negative effect on ROE at the 1% level. This confirms Hypothesis 1.

In addition, asset-liability ratio of real estate enterprises is positively affected by the intensity of tightened policies at the 1% significance level, and real estate regulatory intensity is negatively correlated with the quick ratio of real estate enterprises at the 1% significance level. This supports Hypothesis 2.

5.2. Subsample regressions

There are differences in financing channels and costs between state-owned and non-state-owned real estate enterprises. Stated-owned enterprises have easier access to bank loans than non-state-owned enterprises, especially in a period of tightened policy, leading to the difference in liquidity between state-owned and non-state-owned enterprises. Due to the close relationship between state-owned real estate enterprises and the government, when governments implement tightened policies, they are conservative to step up land acquisitions and expansion plans. Moreover, they have easier access to the urban renewal programs, suffer relatively lower policy shocks.

Therefore, based on the ownership nature of enterprises, we divide the whole sample into a subsample of state-owned real estate enterprises and a subsample of non-state-owned real estate enterprises; then, we investigate the influence of government policies on the liquidity of state-owned and non-state-owned real estate enterprises separately. The regression results are presented in Table 8.

Table 7. Fixed-effects panel regressions of REGP index

	(1)	(2)	(3)	(4)
	ROE	*ROA*	*Lev*	*Qr*
REGP	–0.109***	–0.045***	0.112*	–0.540**
	(–2.834)	(–3.282)	(1.727)	(–2.288)
Lnnumem	–0.008**	–0.008***	0.063***	–0.302***
	(–2.204)	(–6.236)	(10.190)	(–13.330)
Icgrowth	0.011***	0.004***	–0.000	–0.022**
	(6.754)	(6.721)	(–0.047)	(–2.138)
Tagrowth	0.068***	0.015***	–0.000	0.119
	(5.666)	(3.653)	(–0.009)	(1.634)
Tator	0.111***	0.047***	–0.093**	0.481***
	(4.698)	(5.946)	(–2.443)	(3.468)
Price-to-income	–0.013	–0.007	0.006	0.048
	(–0.689)	(–1.091)	(0.174)	(0.409)
_cons	0.225	0.139**	0.157	2.555**
	(1.364)	(2.348)	(0.557)	(2.487)
Firm-fixed effect	Yes	Yes	Yes	Yes
N	1289	1308	1312	1312
R^2	0.1403	0.1533	0.1026	0.1793

Notes: ***, and ** denote variables that are statistically significant at the 1%, and 5% levels, respectively. The values of t are in parentheses.

Table 8. Regression results of state-owned and non-state-owned enterprises

	Qr	Qr	Lev	Lev
	State-owned	Non-state-owned	State-owned	Non-state-owned
REGP	−0.388	−0.751**	0.045	0.192*
	(−1.363)	(−2.009)	(0.716)	(1.706)
Lnnumem	−0.185***	−0.390***	0.054***	0.074***
	(−6.096)	(−11.535)	(7.928)	(7.452)
Icgrowth	−0.024	−0.018	0.000	0.001
	(−1.505)	(−1.259)	(0.015)	(0.235)
Tagrowth	0.191**	0.115	0.020	−0.014
	(2.064)	(1.020)	(0.962)	(−0.422)
Tator	0.473**	0.506**	−0.093**	−0.115*
	(2.433)	(2.556)	(−2.158)	(−1.923)
Price-to-income	−0.075	0.164	0.011	0.001
	(−0.533)	(0.879)	(0.350)	(0.012)
_cons	2.658**	2.376	0.177	0.110
	(2.163)	(1.456)	(0.649)	(0.224)
Firm-fixed effect	Yes	Yes	Yes	Yes
N	692	531	692	531
R^2	0.1284	0.2402	0.1540	0.1094

*Notes: ***, **, and * denote variables that are statistically significant at the 1%, 5%, and 10% levels, respectively. The values of t are in parentheses.*

According to Table 8 the intensity of tightened policies has a significant negative effect on the asset-liability ratio of non-state-owned enterprises, but has no significant effect on the asset-liability ratio of state-owned enterprises. We further perform a Chow test on the two subsamples. The result of the Chow test shows that the difference between the coefficients of regulatory policy on state-owned and non-state-owned enterprises is −1.421, and is significant at the 1% level. It is consistent with the results in Table 8.

Similar to the results of the asset-liability ratio, the tightened policies have a significant positive effect on the quick ratio of non-state-owned enterprises at the 1% level, but have no significant effect on the quick ratio of state-owned enterprises. The result of the Chow test shows that the difference in coefficients between the two subsamples is 0.192 at the 5% significant level, which is consistent with the results in Table 7. This result provides support for Hypothesis 3.

5.3. Evidence using instrumental variable

As we noted in Section 3, tightened government policies increase the financing cost of enterprises and land purchases, resulting in an increase of asset-liability ratio. However, the government tends to implement more tightened policies to reduce the asset-liability ratio, thereby raising the concern of reverse causality. The REGP index can be endogenous to the performance of real estate enterprises and bias the estimates.

To deal with this problem, we employ an instrumental variable approach in our baseline regressions. We use the increase rate of urbanization degree as the instrumental

Table 9. Performance of real estate enterprises and REGP index, instrumented evidence

Variables	(1)	(2)	(3)	(4)
	ROA	ROE	Lev	Qr
Second stage				
REGP	−0.012***	−0.028*	0.082***	−0.354***
	(0.007)	(0.020)	(0.032)	(0.118)
First stage				
Instrumental variable	25.931***	24.904***	26.239***	25.878***
	(1.961)	(2.007)	2.042	(1.957)
Anderson LM	151.120	135.107	142.264	151.106
Cragg-Donald Wald F	174.857	153.946	165.050	174.787
Observations	1308	1289	1312	1312
Controls	Yes	Yes	Yes	Yes

variable. The urbanization rate is the ratio of permanent urban resident to the total population in China. The dependent variables are the same as models (1)–(4). In the upper panel of Table 9, we can see the results of instrumental variable regression are the same with the results of baseline regression. The results for the first stage show that the instrument variable is significant and positively correlated with the REGP index.

5.4. Robustness checks

In this section, we explore the robustness of our finding mainly in three ways. First, we replace our indicator of real estate government policy by using M2 and the total bank

Table 10. Panel regressions of M2 and bank loans

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROE	ROA	Lev	Qr	ROE	ROA	Lev	Qr
M2	0.043***	0.018***	−0.044*	0.213**				
	(2.834)	(3.282)	(−1.727)	(2.288)				
BankLoan					0.052***	0.021***	−0.053*	0.256**
					(2.834)	(3.282)	(−1.727)	(2.288)
Lnnumem	−0.008**	−0.008***	0.063***	−0.302***	−0.008**	−0.008***	0.063***	−0.302***
	(−2.204)	(−6.236)	(10.190)	(−13.330)	(−2.204)	(−6.236)	(10.190)	(−13.330)
Icgrowth	0.011***	0.004***	−0.000	−0.022**	0.011***	0.004***	−0.000	−0.022**
	(6.754)	(6.721)	(−0.047)	(−2.138)	(6.754)	(6.721)	(−0.047)	(−2.138)
Tagrowth	0.068***	0.015***	−0.000	0.119	0.068***	0.015***	−0.000	0.119
	(5.666)	(3.653)	(−0.009)	(1.634)	(5.666)	(3.653)	(−0.009)	(1.634)
Tator	0.111***	0.047***	−0.093**	0.481***	0.111***	0.047***	−0.093**	0.481***
	(4.698)	(5.946)	(−2.443)	(3.468)	(4.698)	(5.946)	(−2.443)	(3.468)
Price-to-income	−0.011	−0.006	0.003	0.059	−0.009	−0.006	0.002	0.068
	(−0.587)	(−0.985)	(0.104)	(0.525)	(−0.510)	(−0.905)	(0.051)	(0.612)
_cons	−0.429***	−0.129***	0.830***	−0.688	−0.344***	−0.095**	0.743***	−0.270
	(−3.368)	(−2.933)	(3.940)	(−0.898)	(−3.191)	(−2.535)	(4.160)	(−0.416)
Firm-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1289	1308	1312	1312	1289	1308	1312	1312
R^2	0.1403	0.1533	0.1026	0.1793	0.1104	0.1403	0.1026	0.1793

Notes: ***, and ** denote variables that are statistically significant at the 1%, and 5% levels, respectively. The values of t are in parentheses.

Table 11. Regression results of the robustness test

	ROE	Lnebits
REGP	−0.100***	−2.359***
	(−2.602)	(−7.115)
Lnnumem	−0.008**	0.456***
	(−2.205)	(14.001)
Icgrowth	0.011***	0.086***
	(6.648)	(5.981)
Tagrowth	0.078***	0.382***
	(6.211)	(3.727)
Tator	0.097***	−0.273
	(4.031)	(−1.345)
Cfo	0.081***	
	(2.714)	
Price-to-income	−0.010	−0.143
	(−0.528)	(−0.883)
_cons	0.199	18.973***
	(1.206)	(13.290)
N	1289	1219
R^2	0.1172	0.4198
Firm-fixed effect	Yes	Yes

Notes: *** and ** denote variables that are statistically significant at the 1% and 5% levels, respectively. The values of t are in parentheses.

loans of real estate enterprises, respectively, since M2 is used as an indicator of monetary policy, and total amount of new bank loans of real estate enterprises is used as an indicator of macro-prudential policy. Table 10 shows the impact of monetary and macro-prudential policy on the real estate enterprises. Due to the negative correlations between REGP and M2, REGP and bank loans, the regression results of M2 and bank loans are consistent with the regression results of REGP.

Second, we extend model (2) by including the control variable of Cfo. The definition of Cfo is presented in Table 3. Third, we change the dependent variable of model (1) with earnings before interest and tax (ebits). Ebits can also reflect the profitability of real estate enterprises, so we replace ROA in model (1) with the natural logarithm of ebits. Table 11 reports the regression results based on the extended models. The results are statistically similar to the preceding ones drawn from the baseline models, and thus further support our hypotheses.

6. Conclusions

We explore the relationship between real estate government policy and real estate enterprise performance in China. The importance of real estate government policy in shaping the house prices and the investment practices of real estate enterprises has long been emphasized (Lemmon & Roberts, 2010; Yu et al., 2017; Kang et al., 2021). However, research on the construction of a real estate regulatory intensity index, especially in the context of examining the influence of tightened policies on the real estate firm performance, is very limited. Our paper fills this gap.

We first constructed the real estate regulatory intensity index by collecting Chinese national housing policies from 2007 to 2019, and analyzing the specific impact of government policies on real estate enterprise performance from

the aspects of monetary, fiscal, macro-prudential, land and administrative policies. Then, we explored the impact of real estate policies on the performance of real estate enterprises based on the data from 103 real estate enterprises listed on A-shares market. The regression results show the following: (1) Tightened real estate policies are negatively correlated with the profitability of real estate enterprises. (2) Tightened real estate policies are inclined to lead real estate enterprises into weak liquidity because of their high asset-liability ratio and aggressive expansions during the housing boom. (3) Tightened real estate policies have less influence on the liquidity of state-owned real estate enterprises than non-state-owned enterprises.

Our paper contributes to the literature on the impact of government policies on the performance of enterprises. We are the first to construct a Chinese real estate regulatory policy intensity index and analyze the effect of government policies on the profitability and liquidity of real estate enterprises. Our study makes two important practical contributions.

First, from the perspective of the government, it is important to pay attention to the bankruptcy risk of non-state-owned real estate enterprises during the tightened period. Chinese real estate industry is highly indebted, and the average asset-liability ratio of enterprises is as high as 63.9% in 2019. The strict policies raise the asset-liability ratio of non-state-owned real estate enterprises, and lower their liquidity. China has implemented the strictest real estate regulations since the end of 2016, which lead to the China's 2020–2022 real estate crisis. The liquidity risk of enterprises rises with the implementation of strict regulatory policy. Therefore, governments should prepare countermeasures in advance to prevent the liquidity risk of enterprises, when they implemented tightened policies to cool down the housing market.

Second, from the perspective of real estate enterprises, the high asset-liability ratio of real estate enterprises, especially non-state-owned enterprises, make them suffer more policy shocks. Therefore, in order to avoid liquidity risks, non-state-owned enterprises should reduce leverage and restrict aggressive expansion during the tightened period.

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Conflict of interests

The authors declare no conflict of interests.

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