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Research on the Credit Risk of Private Real Estate Enterprise Bonds under the Background of Real Estate Regulation

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Abstract: Adhering to the positioning of "no speculation in real estate and housing", China has successively promulgated "345" new regulations, loan concentration management and other real estate industry regulatory policies, further tightened the industry's financing environment, gradually exposed the credit risks of real estate enterprises under high leverage operation, and bond default events have occurred frequently since 2018. In this context, the article divides the period from 2018 to 2021 into three concentrated default stages in combination with the real estate regulatory policy, explores the factors that cause the bond default of real estate enterprises, and explains the credit risk changes of private enterprises by quantitative analysis. The results show that the credit risk of the real estate industry is deteriorating, and the default risk of private enterprises is greater than that of state-owned enterprises. Finally, some referential suggestions are put forward for the steady and healthy development of the industry.

Keywords: Real estate industry; Credit risk; Bond default; Private enterprise

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1. Introduction

The real estate industry is an important industry related to the country and people's lives, and has a strong driving effect on the macro-economy. In the face of excessively fast-rising house prices, China first proposed "no speculation in real estate and housing" in 2016. Since then, the regulatory policies for the real estate industry have been intensively introduced, and the financing channels of real estate enterprises have been gradually tightened. Since the first domestic real estate enterprise defaulted on its bonds in 2018, credit risk events have occurred in the industry. Not only has the credit status of small and medium-sized real estate enterprises deteriorated, but also the credit status of some large real estate enterprises has attracted market attention. At the meeting of the Political Bureau of the CPC Central Committee in 2022, it was clearly pointed out that "it is necessary to effectively control key risks and maintain the bottom line of no systemic risks." Under the orientation of "no speculation in housing

and housing", it is particularly important to reduce the credit risk of real estate enterprises and maintain the healthy development of the industry.

The bond market is an important financing channel for the real estate industry. Since 2015, the issuance of domestic bonds by real estate enterprises has exploded, and the amount of overseas bonds has increased year by year. In 2021, the bond repayment period began. However, in the downward cycle of the industry, factors such as the impact of the epidemic and the shortage of funds within the company have been superimposed, resulting in bond defaults by many real estate enterprises, of which private enterprises account for a large proportion. In addition, some credit rating agencies do not directly consider the impact of the domestic macro environment and industry background; their risk early warning ability is weak, and there is information asymmetry in the capital market. Therefore, it is necessary to analyze the factors that lead to the default of real estate companies in order to identify and prevent the occurrence of bond credit risks.

In view of this, this paper summarizes the overall situation of bond defaults of real estate enterprises in combination with real estate regulatory policies, divides 2018–2021 into three concentrated default periods, inspects the main risk factors of defaulting real estate enterprises from a qualitative perspective, and measures the default risks of different types of corporate bonds by combining quantitative means. Finally, it provides some suggestions for the steady development of the real estate industry.

2. Literature review

Nowadays, there is a lot of literature about the default risk of corporate bonds. This paper will mainly sort out the relevant literature from two aspects: one is about the factors affecting bond default, and the second is about the measurement of credit risk.

In terms of the influencing factors of bond default, Kay Giesecke et al. found that GDP growth rate has a warning effect on bond default. When the economic situation is bad, the probability of bond default is relatively high [1]. Benzion et al. studied the relationship between the company's own qualifications, debt structure, and the company's credit risk. The research results show that enterprises with better qualifications are more likely to issue bonds, but at the same time, companies with worse qualifications have a higher debt ratio compared with enterprises in the same industry [2]. Similarly, domestic researchers also conducted research from the perspective of industry and macro-economy [3–4]. In addition, Zhang Qiang and Sui Xueshen conducted a statistical analysis of the bond default problem. The research results show that the internal reasons of the company are the main reasons, and the external reasons play an inducing role [5]. Lan Faqin et al. conducted research from the perspective of industry sensitivity, and found that the default rate of real estate and other industries has increased in recent years, and the aggregation area of default subjects has moved to the south [6].

In terms of default risk measurement, foreign scholars' research on bond risk has been relatively mature. Altman screened 22 financial indicators and finally constructed the classical financial risk measurement model Z-score Model [7]. In 1997, KMV company developed the KMV model based on the model established by Merton (1974), which can reflect the market expectation and the default risk of enterprises in time by calculating the default distance [8]. On the basis of the above research, domestic scholars continue to deepen. Yang Xiuyun et al. believe that the comprehensive use of the KMV model and financial data of financial companies will make the results more reliable in credit rating based on qualitative and quantitative analysis. In recent years, some scholars have begun to use machine learning methods to predict and measure the possibility of credit risk [9]. Xiao Jiayi

combined a BP neural network with the KMV model to estimate the data of unlisted companies when measuring the default risk of unlisted company bonds [10].

3. Default in the real estate industry

As listed in **Table 1**, according to the real estate control policy and the company's default situation, the defaulting real estate enterprises in 2018–2021 are generally divided into three centralized defaults. In the first centralized default, due to the loose financing environment of the industry in the early stage, house prices rose rapidly. At the central economic conference at the end of 2016, it was proposed for the first time that "housing and housing should not be speculated". Subsequently, differentiated credit policies were implemented one after another, and a housing system combining rent and purchase was built to limit demand; At the same time, check the trust business carried out in violation of regulations, prohibit bank financing and trust funds from flowing into the real estate market in violation of regulations through banking and credit business, and restrict the inflow of funds from the supply side. The simultaneous efforts of both supply and demand have gradually exposed the risks accumulated by some companies under the rapid expansion. It can be seen from **Figure 1** that the ratings of the five default real estate enterprises from 2018 to 2019 are all AA, and the asset scale at the time of default is not much different, all of which belong to small private real estate enterprises.

In the second centralized breach of contract, China reiterated that "no speculation in housing" and stressed that the economic policy was relatively loose due to the impact of COVID-19 in 2020. However, the operating conditions of real estate enterprises are still poor, and the sales at the demand side have fallen more than expected, which has hindered some companies from collecting money. On the supply side, the production stoppage and shutdown led to the slow development progress of the company's stock projects, the reduction of the inventory removal rate, and the breakage of the capital chain.

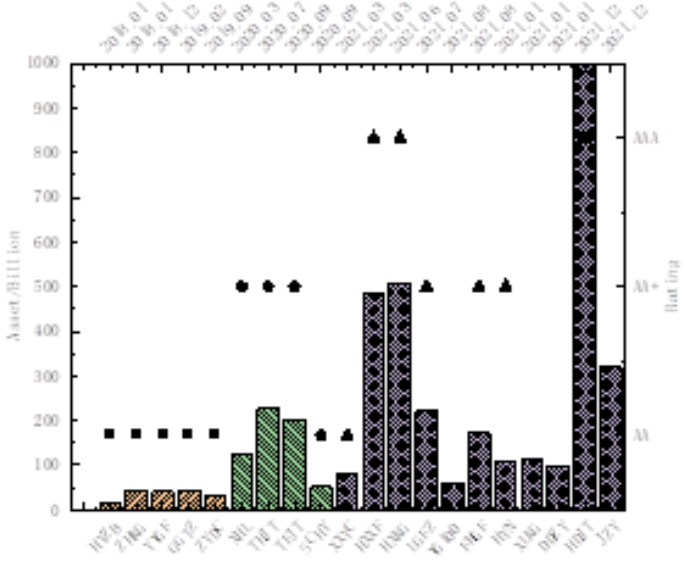

Figure 1. Asset scale and credit rating of default enterprises

In addition, compared with the companies that defaulted before, these real estate enterprises have a larger volume. Three of them have an asset scale of more than 100 billion yuan, a higher main rating, and an increase in

the default balance.

Due to the corresponding economic stimulus policies during the epidemic, the price of commercial housing in some regions rose rapidly, and then the real estate regulation policy was further intensified. In 2020, the state put forward the "three red lines" and the real estate loan concentration management policy, which were implemented in 2021. The real estate market has taken a sharp turn for the worse, and the credit risks of the industry have been exposed and worsened, resulting in the third concentrated default. In 2021 alone, there were as many as 11 defaulting real estate enterprises, almost all of which were listed private enterprises, and the company's asset scale increased significantly. In addition, in terms of corporate ratings, the domestic main ratings of the three companies when issuing bonds were all AAA, and the overall ratings were also significantly higher than the previous two stages.

Table 1. Overview of the default of domestic real estate companies in 2018–2021

	First default	Debt issuer	Enterprise type	Whether to list
The first centralized default (Real estate regulation tightens)	2018.01	HYZB	Private	NO
	2018.01	ZHKG	Private	NO
	2018.12	YYGF	Private	YES
	2019.02	GGTZ	Private	NO
	2019.09	ZYDC	Private	NO
The Second centralized default (COVID-19 pandemic shock)	2020.03	XHL	Private	NO
	2020.07	THJT	Private	YES
	2020.09	TFJT	State-owned	NO
	2020.09	SCHY	Private	NO
The Third centralized default ("Three red lines", real estate loan concentration management, etc.)	2021.03	XXYC	Private	NO
	2021.03	HXXF	Private	YES
	2021.06	HXKG	Private	NO
	2021.07	LGFZ	Private	YES
	2021.08	YG100	Private	YES
	2021.08	FHGF	Private	YES
	2021.01	HYN	Private	YES
	2021.01	XLKG	Private	YES
	2021.01	DDZY	Private	YES
	2021.12	HDJT	Private	YES
	2021.12	JZY	Private	YES

4. Analysis of default factors of enterprise bonds

4.1. Macro and industry level analysis

At present, China's economy has entered the "new normal." The real estate industry has a typical pro-cyclical nature, which is bound to be affected by the macroeconomy. In terms of demand, the sluggish willingness of residents to buy houses has led to a larger-than-expected decline in real estate sales. On the supply side, enterprises are suffering from epidemic prevention and control. The original projects are slow to start. Under the influence of both sides of supply

and demand, the debt repayment pressure of real estate enterprises has posed a great test to cash flow.

The financing of the real estate industry has been under policy constraints and faced with greater policy risks. It can be seen from **Table 2** that since 2016, the growth rate of funds has obviously shown a downward trend. Although there are abundant financing channels, the actual funds have grown slowly. It is likely that low-cost financing methods, such as standardized bonds in the industry, are not enough to cope with the huge debt repayment pressure.

Table 2. Funds and growth rate of the real estate industry in 2015–2020

Time	2015	2016	2017	2018	2019	2020	2021
Funds	12.52	14.42	15.61	16.64	17.86	19.31	12.52
YOY	2.6%	15.18%	8.21%	6.64%	7.33%	8.12%	2.6%

4.2. Summary of default factors of real estate enterprises

This paper summarizes the characteristics of four aspects by combining the defaulting real estate enterprises.

1) In the stage of rapid development of real estate, some companies will rely on huge profit space to diversify into other industries, and some companies will accelerate the layout of national businesses. However, due to the rapid investment pace of real estate enterprises, a large amount of cash of the company was consumed, and even a large loss of investment projects occurred, resulting in their own capital shortage and debt crisis.
2) Real estate enterprises generally adopt the high-leverage operation strategy to make up for the funds needed for the early-stage project development. However, if the project development link is blocked or the real estate sales decline, it may lead to a large amount of funds being deposited in the existing projects, which may lead to a debt crisis. At the beginning of the outbreak of COVID-19 in 2020, many real estate project development was suspended for a time, and the project decentralization rate plummeted. Some companies could not bear the short-term pressure of funds, resulting in default.
3) In order to obtain non-standard financing from trust companies and other institutions, enterprises have mortgaged a large amount of the company's assets, but when it is difficult to cash bonds, they cannot sell the mortgaged assets. In addition, the location of real estate projects of some real estate enterprises has sunk to lower-tier cities, with accumulated inventories and low liquidity. Some companies have limited monetary capital, because many regions limit the scope of use of pre-sale funds, which is limited to the development of related projects, so that companies cannot arrange to repay debts at will. Therefore, when the company is faced with debt repayment demands, even if the company has more cash on its books, most of it has been restricted and cannot repay the debts when they become due.
4) In order to meet the needs of debt index supervision, many enterprises have taken part of their debts off the balance sheet or modified them into equity, and the hidden debt problem is relatively serious. Nominally, minority shareholders' rights in companies often come from joint development projects with other companies, but at the end of the project, the enterprise must buy back these minority shareholders' rights with capital contributions. In addition, the debt of the project company controlled by the real estate enterprise is not directly reflected in the consolidated report of the company, and the debt is listed. Once these off-balance sheet liabilities mature, it is easy to lead to a large amount of cash expenditure of the company and trigger a liquidity crisis.

5. Default analysis and evaluation based on the Z-Score model and the KMV model

5.1. Credit risk analysis based on the Z-score model

The Z-score model was proposed by economist Altman in 1968. By selecting important financial ratio indicators and giving them certain weights, a comprehensive score value is calculated to measure the financial health of enterprises.

Its model expression is:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

Where:

X_1 = working capital / total assets

X_2 = retained earnings / total assets

X_3 = profit before interest and tax / total assets

X_4 = owner's equity / total liabilities

X_5 = operating income / total assets

Generally speaking, the higher the Z value, the better the overall financial performance of the enterprise, and the less likely the corresponding credit risk will occur. When the Z value is less than or equal to 1.81, the financial situation is worrying, and the possibility of bond default is also high; When the Z value is between 1.81 and 2.675, the financial situation of the enterprise needs to be paid attention to; the financial situation is unstable, and credit risk may occur; When the Z value is greater than 2.675, it can be inferred that the company's financial condition is good and the probability of default is low.

This paper selects real estate development enterprises in the Shen-wan industry and A-share listed companies with existing bonds by the end of 2021. The total number of enterprises is 66, including 40 state-owned enterprises and 17 private enterprises, accounting for nearly 25% of the total. Other types include 9 collective and foreign-funded enterprises.

As shown in **Figure 2**, the Z-value of the sample companies has been in the range of a worrying financial situation since 2015, and the credit situation has been deteriorating. Since 2017, the real estate regulatory policy has become stricter. In 2018, the first company defaulted, which triggered the first centralized default. It can be seen that the Z-value of private enterprises fluctuates significantly. Although the Z-value of state-owned enterprises has decreased, the change is not large, and is generally higher than the industry average, reflecting the credit risk resistance of state-owned real estate enterprises. Under the influence of regulatory policies and other factors, in 2019, the financial leverage ratio of real estate enterprises decreased, the short-term solvency was strengthened, and the financial situation of the whole industry was improved, among which private real estate enterprises performed significantly.

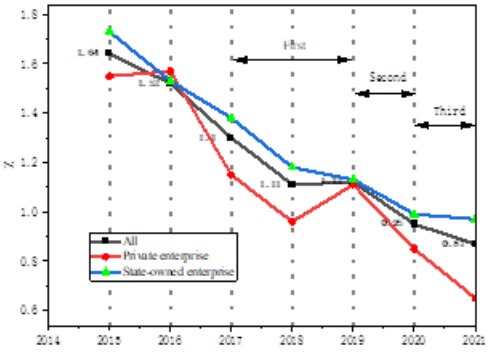

Figure 2. Changes in the Z value of the real estate industry from 2015 to 2021

In the second stage, private enterprises reacted more violently to the impact of the epidemic, and the Z value fell from 1.24 in 2019 to 0.85 in 2020. In the third centralized default, with the implementation of the "three red lines" and other policies, it was also at the peak of domestic credit debt repayment, and the pressure on bond financing enterprises to repay their funds was huge. The financial risks of private enterprises and state-owned enterprises were further differentiated, and the financial situation of state-owned enterprises was relatively stable. However, 11 companies of private real estate enterprises defaulted in 2021, and their financial situation further deteriorated.

In order to further investigate the distribution of the company's Z-value, the article counts the number of specific sample companies in the three segments of the Z-value. It can be found from **Table 3** that the number of companies with $Z > 2.675$ has significantly decreased year by year, and many enterprises have experienced thunderstorms from 2018 to 2021. The number of companies with $1.81 < Z < 2.675$ also showed a downward trend. The proportion of companies with $Z < 1.81$ continued to increase from 2015 to 2021. At the end of 2021, nearly 94% of the companies had high financial risks. In addition, the number of state-owned companies with $Z > 1.81$ is mostly, and some of these state-owned enterprises are directly or indirectly held by the City Investment Corporation.

Table 3. Distribution of the Z-value interval of the sample companies

Z value	2015	2016	2017	2018	2019	2020	2021
Z<1.81	52	52	55	61	61	64	62
1.81<Z<2.675	7	8	10	5	4	2	4
Z>2.675	7	6	1	0	1	0	0

Based on the above analysis, this paper selects 10 listed companies with a city investment background. As shown in **Table 4**, the shareholding of City Investment Corporation will have a positive impact on the credit of real estate companies.

Table 4. Average Z-value of the urban investment background company and City Investment background company

Average Z value	2015	2016	2017	2018	2019	2020	2021
State-owned	1.73	1.53	1.38	1.18	1.13	0.99	0.97
City Investment Company holding	2.08	1.84	1.64	1.46	1.50	1.27	1.18

5.2. Credit risk analysis based on the KMV model

Although the Z-score model can explain the increase in the overall credit risk of the real estate industry, and can also reflect the financial changes of real estate companies in each concentrated default period. However, companies with $Z < 1.81$ account for the vast majority, which is slightly different from the actual situation. Moreover, the model performs poorly in identifying the credit risk differences between private real estate enterprises and state-owned real estate enterprises. In order to further measure the credit risk of the company and reflect the gap between the credit risk of private and state-owned real estate enterprises, the article excludes 10 listed real estate companies held by CIC from the existing sample. At this time, the sample companies include 17 private enterprises and 30 state-owned enterprises. The KMV model is adopted to measure the default distance between private real estate enterprises and state-owned real estate enterprises and estimate the default probability.

This model is based on the Black Scholes Merton option pricing model, and takes the debt value (D) as the

agreed price of European call options. When the company's asset value (V) is lower than the agreed price (D), it will default. This model calculates the probability of default (EDF) at the maturity of debt, that is, P (VT≤D), and defines the default distance (DD) as the distance between the company's asset value and debt value. The smaller the default distance, the greater the probability of default, indicating that the company's credit risk is greater.

The steps for calculating the expected default probability of the company under the KMV model mainly include:

1) According to the closing price of the company's shares, this paper calculates the volatility of the company's equity value according to the historical volatility method, takes the one-year lump sum deposit and withdrawal interest rate of the central bank as the risk-free interest rate, and derives the formula of the company's asset value V and Volatility (σ_v) according to the B-S-M model and the relationship between the volatility of the equity value (σ_E) and the volatility of the company's asset value (σ_v).

$$E = VN(d_1) - De^{-r(T-t)}N(d_2) \tag{1}$$

Wherein,

$$\begin{cases} d_1 = \frac{\ln\left(\frac{V}{D}\right)+(r+\frac{\sigma_v^2}{2})(T-t)}{\sigma_v\sqrt{T-t}} \\ d_2 = d_1 - \sigma_v\sqrt{T-t} \end{cases} \tag{2}$$

According to the fact that equity value (E) is a function of asset value (V) and time (t), and asset value (V) obeys geometric Brownian motion, it can be concluded that equity value (E) also obeys geometric Brownian motion. The relationship between the volatility of equity value (σ_E) and the volatility of the company's asset value (σ_v) is as follows:

$$\frac{\sigma_E}{\sigma_v} = \frac{V}{E}N(d_1) \tag{3}$$

2) Calculate the default point (DP) and the default distance (DD) according to the corporate liabilities, where the default point = short-term debt + 0.5 * long-term debt, and the default distance (DD) refers to the distance between the expected asset value of the company and the default point, which has nothing to do with the size of the company. It is a standardized indicator. The calculation formula is as follows:

$$DD = \frac{E(V)-DP}{E(V)\sigma_v} \tag{4}$$

3) If it is assumed that the asset value of the enterprise follows a normal distribution, it represents the standard deviation of the company's default distance. Therefore, the expected theoretical default probability (EDF) of the enterprise can be obtained as follows:

$$EDF = N(-DD) \tag{5}$$

Due to the late start of China's corporate bond market and the large-scale outbreak of default, it is impossible to establish a default database and obtain the one-to-one correspondence between default distance and expected default rate. Therefore, this paper takes the distance to default (DD) as an indicator to measure the company's credit risk. As shown in **Table 5**, according to the statistical description of the default distance of sample companies in different groups from 2015 to 2021, it is found that the default distance plays a more accurate and significant role in distinguishing the default risk of bonds of listed real estate companies of different natures.

Table 5. Sample companies default distance statistical analysis table

	Time	Group	Average value	Standard deviation
Before the centralized bond default	2015	Private	1.59	0.56
		State-owned	1.83	0.51
	2016	Private	3.47	1.08
		State-owned	3.64	1.29
	2017	Private	5.57	1.90
		State-owned	5.84	2.61
First centralized bond default	2018	Private	4.40	1.45
		State-owned	5.20	2.15
	2019	Private	4.53	1.03
		State-owned	5.81	2.63
Second centralized bond default	2020	Private	5.06	1.45
		State-owned	6.48	3.96
Third centralized bond default	2021	Private	5.38	2.34
		State-owned	7.07	4.39

From the perspective of the mean and standard deviation, there was little difference between the mean and standard deviation of the default distance between private and state-owned enterprises from 2015 to 2017. In the three concentrated default periods, the standard deviation of state-owned enterprises is significantly higher than that of private enterprises, which indicates that the default distance of private real estate enterprises is relatively concentrated. And because the average default distance of private real estate enterprises is smaller than that of state-owned real estate enterprises, it indicates that the possibility of concentrated default of private enterprise bonds is higher. The dispersion of the default distance of state-owned enterprise bonds is large, which indicates that the default probability of some state-owned enterprise bonds is still relatively high, which deserves attention.

In order to more intuitively reflect the change of credit risk gap, this paper draws the average change of default distance of different enterprise types from 2015 to 2021. As shown in **Figure 3**, the default distance of state-owned enterprises and private enterprises has increased in volatility, and the average difference between the default distance of state-owned enterprises and private enterprises is not large between 2015 and 2017. However, since 2018, the average default distance has decreased significantly, and private enterprises have decreased significantly. Although the average default distance has increased from 2019 to 2021, the gap between the two has become wider and wider, which indicates that after 2018, the credit risks of state-owned real estate companies and private real estate companies have been seriously differentiated, and the probability of default of private real estate

enterprises is greater.

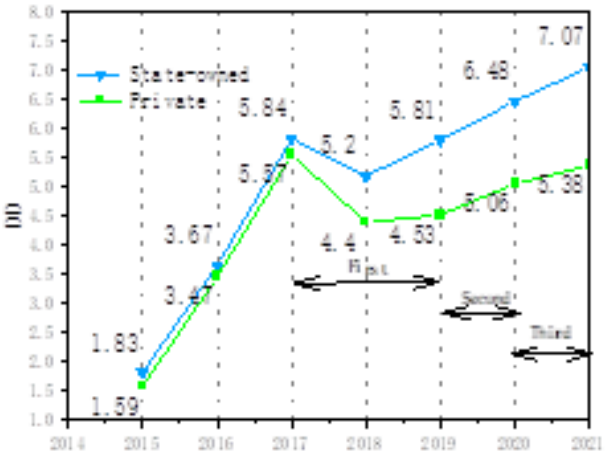

Figure 3. The average value of the default distance (2015–2021)

6. Conclusions and suggestions

The article summarizes 20 default cases that occurred from 2018 to 2021, and divides this period into three concentrated default periods. It is found that the vast majority of defaulting companies are private enterprises. The Z-score Model found that: (1) under the period of three concentrated defaults, the overall financial situation of the industry gradually deteriorates; (2) There is a gap in credit risk between state-owned real estate enterprises and private real estate enterprises; (3) The financial performance of real estate enterprises held by CIC is better than that of state-owned real estate enterprises. Further, the KMV model can more accurately depict that the gap between the default distance of private real estate enterprises and state-owned real estate enterprises is growing, which confirms that the possibility of credit risk of private real estate enterprises is higher than that of state-owned real estate enterprises in recent years. In order to prevent and resolve the occurrence of credit risks in the real estate industry, the article puts forward relevant countermeasures and suggestions from the following aspects.

Real estate companies are currently in the phase of elimination, and the possibility of credit risk of private real estate enterprises with weak qualifications is increasing. In the face of debt repayment pressure, real estate companies can first extend the bonds and exchange the bonds that are about to expire through an offer to avoid default. Secondly, the company can introduce state-owned assets and strategic investments to obtain credit endorsement, so as to enhance liquidity. Finally, the company can quickly obtain cash flow, reduce its own burden, and reduce the probability of credit risk by selling project equity and selling diversified businesses.

In order to stabilize the real estate market and to adhere to the positioning of “live without speculation”, government departments should formulate more reasonable counter-cyclical control policies for real estate. Under the urgent requirements of stabilizing house prices, land prices, and expectations, the government should make full use of the policy portfolio tools in the toolbox. The demand side can reduce the mortgage interest rate and the down payment ratio to stimulate residents’ demand for house purchase. The supply side can formulate corresponding real estate financial policies to support the reasonable financing needs of the company. In addition, rating agencies should also improve their rating indicators in combination with the characteristics of the current

domestic real estate market.

Disclosure statement

The author declares no conflict of interest.

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