

An Empirical Study on The Default Risk of Kaisa's Real Estate Industry Before and After COVID-19

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Abstract. In 2019, when COVID-19 outbreaked, the real estate economy, an important component of the economy, must be hit to some extent. Affected by the epidemic and financing situation, Kaisa enterprise recently suffered a credit risk. The debt was increasing and the credit ratings were decreasing. The stock of Kaisa was suspended for a long time. This paper used the financial data of Kaisa enterprise between 2019 and 2021 provided by Eastern Wealth and the financial statements of Kaisa enterprise to measure the credit risk of Kaisa enterprise with the KMV model. The empirical results illustrated that the default probability of Kaisa enterprise was relatively high and the default probability increases to some extent after the outbreak of the COVID-19 epidemic. Between 2020 and 2021, Kaisa enterprise was classified as CCC credit rate according to the Standard & Poor's credit rating table. The data and standard confirmed Kaisa enterprise had a high credit risk. To resolve and prevent credit risks, Kaisa enterprise needs to improve the liquidity of funds, carry out reasonable financing and improve the awareness of risk management.

Keywords: COVID-19; credit risk; credit risk; KMV.

1. Introduction

China's economy stalled in 2020-2021 when COVID-19 outbreaked. As an important pillar of China's economy, the real estate industry would also be affected to varying degrees. At present, most of China's real estate enterprises adopt a high turnover mode, mainly using bank loans to reach capital needs in the process of development. The credit risk of real estate companies may be affected by the sudden outbreak of COVID-19 and the subsequent economic recovery. As the pandemic gets better, the economy was recovering gradually. As an important component of the economy, the real estate economy is expected to see an upward tendency. The managers and investors are concerned about the level that the real estate industry gets in the 'post-epidemic stage' because it is relevant to the pay-back ability and credit risk of an enterprise and it decides the future of the industry. Banks can reject loans to the enterprises and investors can stop investing based on credit risk and pay-back ability.

KMV model is created by the KMV company from San Francisco in 1997 to estimate the default rate of enterprises. Under this circumstance of given liabilities, the KMV model considers that the credit risk of a loan is determined by the market value of the debtor's assets. KMV model has both financial data and market exchange information. These data can reflect the credit status of an enterprise more comprehensively. For these reasons, the KMV model is widely used in the financial market. Meanwhile, it's widely accepted to quantize the credit risk.

In the history of KMV model research, foreign scholars were ahead of domestic scholars in the study of credit risk in the real estate industry. Kim and Addae used the multi-factor least squares model to estimate the international risk premium of direct real estate in North and South Asia and the United States [1]. Deng and Lausberg empirically tested the impact of real estate risks on corporate investment and financing decisions by using a group of American company data from 1985 to 2013. The result of the research provided a new perspective for the study of the impact of real estate on corporate decisions [2]. Lausberg and Lee took the total rate of return, IPD index and real estate index of 939 properties of different types in Germany from 1996 to 2009. The samples analyzed the indicators for measuring real estate risks and proposed to combine quantitative and qualitative risk measurement [3]. It can capture real estate risk to the maximum extent.

China's real estate finance research started later than foreign countries. Two main reasons are incomplete data and limited real estate credit risk measurement. Set the KMV model as an example.

Xie, Zhu Li and Dong used the KMV model to study the credit risks of listed companies and banks. The research provides the KMV model was suitable model for measuring the credit risks of Listed companies in China [4]. Chen, He and Ma used the KMV model to analyze the credit risk of China's listed banks. The research concluded the KMV model is more suitable for measuring the credit risk of China's listed enterprises due to its convenient variable acquisition and calculation [5]. Yin, Z, and Han selected 10 listed real estate enterprises for empirical analysis. Compared with the stock price of enterprises with poor performance, the average default distance of high-performance stock enterprises is larger and the possibility of default of high-performance stock enterprises is smaller. Peng used the KMV model to study the credit risks of 108 listed real estate enterprises in China from 2010 to the beginning of 2018. The research confirmed the default distance of Chinese real estate companies was concentrated in the interval [2,5], and real estate enterprises with larger asset scales had higher default risks [6].

The research object of this paper is the real estate industry of Kaisa Enterprise. Nowadays, the real estate economy is severe and the international rating agencies are downgrading. Kaisa enterprise suffered a liquidity crisis and the enterprise's financial products have not been realized. In the aspect of the stock market, Kaisa's shares on the Hong Kong Stock Exchange have recently been suspended from trading. Credit risk may be one of the reasons to be suspended. In recent years, news about Evergrande Group's increasing debt has emerged one after another. It is particularly important to explore the credit risks of real estate companies in similar industries. This paper adopts the KMV model to study the credit risk of Kaisa enterprise in the pre-epidemic stage and post-epidemic stage, analyzing and comparing the different characteristics of the two stages through the KMV model and revealing the credit status and future.

2. Methodology

The research is about exploring the credit risk of Kaisa enterprise between 2019 and 2021, during the epidemic period. According to the data, the researchers calculated the relevant factors, such as DP (Default point) and DD (Default distance). The specific process will be detailed in the paper.

2.1 Data Collecting

This paper uses the KMV model to measure the credit risk level of Kaisa enterprise before and after COVID-19. The data below are mainly derived from financial statements in the 2021 mid-quarter of Kaisa Company, People's Bank of China statistics and Eastern Wealth.

2.2 Experimental Design

To calculate, this paper used the historical volatility method to analyze the market value and volatility of enterprise equity, expiration time, risk-free interest rate and the book value of liabilities, aiming at estimating the market value of a company's assets and the volatility in asset values. Collecting the SD (Short-term Liabilities) and LD (Long-term Liabilities) data, this paper calculated the DP (default point).

This paper calculated the annual volatility of equity value through the method of historical volatility method. Among the formula. σ_E refers to the volatility of equity value and P_i refers to the closing price on the i day. N refers to the transaction dates of a year for Kaisa and in the time N is equal to 250 days, as formula 1-4 showing.

This paper calculated the DD (Default Distance) of the borrower (Kaisa enterprise) through the DD. According to the relevant relationship between default point and EDF (Expected Default Rate) standard provided by credit rating company S&P (Standard & Poor's), this paper can figure out the detailed relation and estimated EDF of Kaisa enterprise.

2.3 Experimental Design

Aiming at calculating EDF to compare the standard provided by S&P to get the credit rating level, first this paper calculated DP. SD stands for short-term debt and LD stands for long-term debt.

$$DP = SD + \frac{1}{2}LD \quad (1)$$

And second, this paper calculated σ_E . In formula (2), σ_E stands for the volatility of Kaisa's equity, σ_D stands for the volatility of the stock price of Kaisa per day and n stands for the transaction days of a year. In this paper, n is equal to 250.

$$\sigma_E = \sqrt{n}\sigma_D \quad (2)$$

In formula (3), P_i stands for the average closing price of Kaisa enterprise' stock on the i month.

$$\mu_i = \ln \left(\frac{P_i}{P_{i-1}} \right) \quad (3)$$

$$\sigma_D = \sqrt{\frac{\sum_{i=1}^n (\mu_i - \bar{\mu})^2}{(n-1)}} \quad (4)$$

Kaisa enterprise's stock closing price in the basis month (P_i) is shown as Figure 1. between 2019 and 2021.

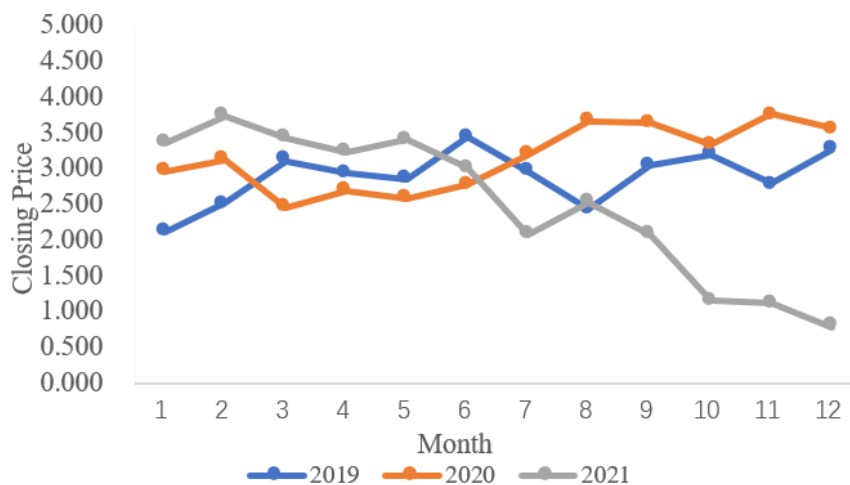


Fig. 1 Kaisa enterprise's stock price between 2019 and 2021

In the fourth step, this paper calculated V_E through formula (5). The data of the total stocks were collected by Eastern Wealth.

$$V_E = \text{total stocks} * \text{Closing price of base month} \quad (5)$$

In formula (6), it is similar to formula (3). V_i stands for the total capital of the i year. The total capital was collected twice a year. σ_D' stands for the average volatility of capital of each settlement period. σ_A stands for the volatility of capital each year.

$$\mu_i = \ln \left(\frac{V_i}{V_{i-1}} \right) \quad (6)$$

$$\sigma_A = \sqrt{n}\sigma_D' \quad (7)$$

In formula (8), DD stands for the default distance.

$$DD = \frac{V_A - DP}{V_A \sigma_A} \quad (8)$$

In formula (9), EDF stands for the expected default rate, N(DD) stands for the probability of default based on the normal distribution table.

$$EDF = 1 - N(DD) \quad (9)$$

Through observing EDF, this paper drew the initial results of the credit risk of Kaisa enterprise.

3. Results and Discussion

3.1 Result of DP References

Nowadays, many enterprises don't default as expected, even though the value of the company's total assets fell or below the book value of the enterprise' total liabilities. Numbers of previous research have found that asset values generally fall between book value and total liabilities. Among the liabilities, the real estate industry considers the long-term liabilities of the total liabilities play a role of buffer. Through lots of previous research done, the most widely accepted method of calculation is the short-term liabilities plus half of long-term liabilities. The calculation results of Kaisa's default point are shown in Table 1.

Table 1. The data of DP of Kaisa enterprise between 2019 and 2021

Time	SD (Billion yuan)	LD (Billion yuan)	DP (Billion yuan)
2019 (T_1)	1153.05	988.30	1647.20
2020 (T_2)	1347.96	953.83	1824.88
2021 (T_3)	1341.52	1035.10	1859.07

As shown in Table 1, during 2019 and 2021, short-term liabilities in 2020 and 2021 are higher than the year 2019 and long-term liabilities in 2021 are higher than the years 2019 and 2020. Frequent financing and a decrease in sales are the main reasons. Too much debt has created a debt pile, calling into a query of the pay-back ability and credit risk.

3.2 Analysis of Annual Volatility of Equity Value (σ_E)

The volatility of months (σ_D), and the volatility of equity (σ_E) were calculated as Table 2 shows.

Table 2. The result of $\bar{\mu}$, σ_D and σ_E in 2019~2021 of Kaisa's enterprise

Time	$\bar{\mu}$	$\sigma_D(\%)$	$\sigma_E(\%)$
2019 (T_1)	0.013	0.033	0.518
2020 (T_2)	0.085	0.030	0.470
2021 (T_3)	-0.233	0.052	0.824

The greater the change in equity volatility, the higher the uncertainty of the company's future. The value of an enterprise is constantly changing. In Table 2, the paper stated σ_E in 2021 was higher than σ_E in 2019 and 2020. Because σ_E in 2020 was not higher than σ_E in 2019, which couldn't confirm that COVID-19 epidemic affected much in the field of volatility.

3.3 Analysis of the V_E

The base day closing price is set as the average closing price for each period. The amount of equity is supported by the financial statements of Kaisa enterprise. The result of the value of equity rights is shown in Table 3.

Table 3. The data of total stock issue, closing price of base date and V_E

Time	Total stock issue (Billion)	Closing price (Yuan)	V_E (Billion yuan)
2019 (T_1)	5.34	2.89	15.43
2020 (T_2)	5.37	3.14	16.86
2021 (T_3)	6.14	2.49	15.29

Equity value refers to the book balance of the equity investment minus the provision for impairment of the investment. The book balance of the equity investment includes the investment cost and the difference of the equity investment. For enterprises with poor ability of management, the equity attraction becomes worse and the equity value will decrease. Equity value reflects the resource integration ability of major shareholders and the management level of the company rather than emergencies to a great extent.

3.4 Analysis of Asset Value Volatility

Table 4. The result of σ_A

Time	V_A (Billion yuan)	σ_A (%)
2019 (T_1)	2590.13	0.041
2020 (T_2)	2924.31	0.022
2021 (T_3)	3191.12	0.020

Volatility is the degree to which financial asset prices fluctuate. It is a measurement of the uncertainty of return on assets and is used to reflect the risk level of financial assets. The higher the volatility, the more intense the volatility of financial asset prices, and the stronger the uncertainty of asset returns are. The lower the volatility is, the gentler the fluctuation of financial asset price will be, and the stronger the certainty of asset return rate will be.

The calculation of the asset value volatility is similar with the way of volatility of equity value. Using formular (2) to calculate the volatility of each year. One of the disadvantages is that the sample of asset value of Kaisa enterprise is limited. The result of V_A and σ_A are shown in Table 4.

3.5 Analysis of Default Distance (DD) and Expected Default Frequency (EDF)

This paper calculated the expected default frequency assuming that asset values are normally distributed. The results are shown in Table 5.

Table 5. The data of DP of Kaisa's enterprise between 2019 and 2021

Time	DP (Billion yuan)	σ_A (%)	DD	EDF (%)
2019 (T_1)	1647.20	0.041	0.015	6.82
2020 (T_2)	1824.88	0.022	0.010	13.41
2021 (T_3)	1859.07	0.020	0.011	13.24

The expected default frequency of Kaisa enterprise in the three research periods is 6.82%, 13.41% and 13.24%. The probability of default rate changed a lot during the period between 2019 and 2021.

It was a statistical anomaly. With little change in Kaisa's financing situation, it is reasonable to assume that the increase in the expected default probability is due to the pandemic.

This paper introduces the corresponding relationship between the credit rating of S&P (Standard & Poor's) and default probability as the mapping relationship between the credit rating and default probability of the KMV model. The corresponding relationship is shown in Table 6.

Combining the calculation results and Table 6, this paper assessed the credit risk of Kaisa enterprise preliminarily. The detailed results are shown in Table 7.

Table 6. Credit standards of Standard & Poor's (S&P)

EDF of KMV model (%)	Standard of poor's
(0.00,0.02]	AAA
(0.02,0.03]	AA+
(0.03,0.04]	AA
(0.04,0.05]	AA-
(0.05,0.07]	A+
(0.07,0.09]	A
(0.09,0.14]	A-
(0.14,0.21]	BBB+
(0.21,0.31]	BBB
(0.31,0.52]	BBB-
(0.52,0.86]	BB+
(0.86,1.43]	BB
(1.43,2.03]	BB-
(2.03,2.88]	B+
(2.88,4.09]	B
(4.09,6.94]	B-
(6.94,11.78]	CCC+
(11.78,14.00]	CCC
(14.00,16.70]	CCC-
(16.70,17.00]	CC
(17.00,18.25]	C
(18.25,20.00]	D

Table 7. KMV model of Kaisa enterprise's credit rating form

Time	EDF (%)	rate
T_1	6.82	B-
T_2	13.41	CCC
T_3	13.24	CCC

The main body credit risk assessment results of Kaisa enterprise in these three-time spans are much lower than level AA, indicating that the main body credit risk of Kaisa enterprise and the possibility of default is relevant high.

4. Conclusion

This paper is based on the data of Kaisa's enterprise in three-time spans. (2019~2021), using the KMV model to empirically evaluate the credit risk of Kaisa's enterprise. The empirical results are as follows: (1) The default probability of Kaisa's enterprise is increasing during 2019 and 2020, shown as 6.82% and 13.41%. According to Table 7, it was stable during 2020 and 2021. (2) KMV model's credit rating results for Kaisa's enterprise in three-time spans are B-, CCC and CCC respectively. This paper shows that the real estate industry of Kaisa enterprise's credit rating exhibited a downward trend

between 2019 and 2020 and it was stable during 2020~2021. On the premise that the enterprise's financing situation remains unchanged, it's reasonable to estimate that the COVID-19 pandemic had affected the credit risk of Kaisa enterprise's real estate industry. (3) According to the paper, the level of credit rating was much lower than level A. It illustrates that Kaisa's ability to service its liabilities is weak and it can be easily affected by adverse economic conditions. Kaisa enterprise's default risk is relevant high.

The KMV model is dynamic. It can easily be affected by a company's situation. It is easy to calculate the factor needed with the initial data of Kaisa enterprise with the KMV model and the output result is easy to understand. Even if the default database is not completely established in China, the difference in default distance can be used to identify the credit risk difference between different enterprises. In addition, the KMV model has the predictive ability for credit risk to some certain extent. The default probability in the KMV model can be regarded as an early warning indicator of credit risk. Through the output results, the enterprise's managers and investors can identify and avoid risk in some cases, such as the COVID-19 epidemic period.

According to the empirical research results, some advice is listed: Increase the liquidity of funds and finance reasonably. Through debt restriction, equity sales and other ways to relieve the short-term pressure. Reducing the illiquid liabilities of enterprises and increasing the gap between the value of assets and the default point can also improve the default possibility and credit risk. Ensure the quality of construction. Prevent the risk of a bad ending of construction. Increase the confidence of buyers and gradually defuse the liquidity risk through the normal sales of the enterprise's projects. The governance of the capital structure of the company should improve critically to decrease the possibility of default. Kaisa enterprise needs to understand the market mechanism and the financing threshold.

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