

Risk Analysis of Real Estate Enterprises Based on the Z-Score Model

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Abstract. In recent years, the news of China's real estate industry's violent thunder is endless, so it is more important for major real estate enterprises to identify, analyze and prevent financial risks. This paper takes Greenland Group as the research object, selects its financial data from 2015-2022, calculates the relevant financial indicators, adopts the method of combining traditional financial risk analysis and Z-score model, and researches that Greenland Group's solvency, operating ability and profitability are weak, and its financial situation has been in the bankruptcy zone, with high financial risk; and analyzes the reasons for the generation of financial risk. Feasibility suggestions are put forward to help Greenland Group reduce the overall financial risk and provide reference for the majority of real estate enterprises.

Keywords: Z-score Model, Financial Risk, Financial Analysis, Greenland Group.

1. Background Analysis

Real estate industry is one of the most important pillars to support China's economic growth, since the reform and opening up the real estate industry has developed rapidly, which also brings some problems. As the real estate industry is a capital-intensive industry, with a large scale of investment, long development cycle, high leverage ratio, it also has a higher financial risk compared with other industries. In recent years, China's real estate market has experienced an unprecedented "thunderstorm", the news of collapse of major real estate enterprises has been constantly published in the public's field of vision, from Sunac, Country Garden, and other leading enterprises, to small and medium-sized enterprises such as Fullsun, Tahoe and China Fortune Land Development and so on, which has brought a huge blow to the real estate market and the financial market. The nature of the collapse of the major real estate companies is due to the inadequacy of their own financial risk identification and control, and since they have been maintaining a high-risk, high-debt and high-leverage business model in the long term, the capital chain and cash flow rupture ultimately and they plunged into a debt crisis in the great predicament. Therefore, the identification, assessment and prevention of financial risk is an urgent research topic for the real estate industry.

Financial risk has always been a field of research and exploration for many domestic and foreign scholars. As early as the early 20th century, Fitzpatrick (1932) proposed a simple method for identifying financial risk by comparing the differences in financial data and ratios between listed companies with normal and abnormal finances [1]. Subsequently, Beaver (1966) proposed using univariate analysis to calculate relevant financial ratios as the predictive indicators of financial risk [2]. Due to the fact that univariate analysis model considers too few variables and has low accuracy in predicting financial risks, it cannot meet the requirements of enterprises in predicting, evaluating, and preventing their own financial risks, which has huge limitations. Therefore, Altman (1968) enriched and improved the univariate analysis model by introducing a multivariate analysis model [3], which is more accurate in predicting financial risks. Subsequently, Altman, Haldeman, and Narayanan (1977) further improved the multivariate analysis model [3] proposed by Altman (1968) and extended it to the ZETA model [4]. They selected 53 companies with financial anomalies from

1969 to 1975, as well as a corresponding number of financially normal companies, as samples for analysis. Later, Ohlson (1980) increased the sample size and selected 105 bankrupt companies and 205 financially normal enterprises. Using a conditional logistic analysis prediction model, he emphasized that some companies may apply for bankruptcy at some point after the fiscal year date and before the financial statements are published, which previous research did not consider, which may increase investment risk for investors [5]. Since 2000, with the development and popularization of artificial intelligence, it has become easier to identify and manage financial risks. Valverde (2011) proposed that enterprises can use Business Intelligence Systems (BIS) to identify, evaluate, and manage potential financial risks that may arise throughout the entire process of operation, investment, and fundraising [6].

Although China's real estate industry started late and has a relatively short development time, many scholars in China have conducted detailed research on financial risks. Du Yunchao and Xu Fengju(2013) used real estate listed companies as empirical objects, selecting 8 ST companies and 32 companies with normal financial conditions as paired samples. They used a logistic model for empirical research, proving that the accuracy of logistic prediction of corporate financial risk can reach 95% [7]. Wang Sheng (2008) used the Black-Scholes option pricing model and for the first time provided a clear quantitative relationship between real estate pricing and the debt capacity of real estate companies, emphasizing that the excessive pursuit of profit maximization by real estate companies has led to a significant increase in their financial risk [8]. Peng Wenyi (2024) combined entropy weight method and TOPSIS method to construct a financial risk prediction model for steel enterprises. This model was specifically used for case analysis of Liuzhou Iron and Steel Co, Ltd and suggestions were given for this enterprise to change its single product structure and keep up with the market. Wang Ladi and Han Jiangxu(2020) further improved the entropy weight TOPSIS method by constructing the EW-TOPSIS-RSR model, cleverly avoiding the limitation of entropy weight method that can only handle indicator data greater than zero. Negative indicator data was also considered, thereby enhancing the accuracy and comprehensiveness of the model in financial risk assessment [10]. Liu Mengyun and Han Wei (2024) selected 14 financial indicators from five aspects: profitability, solvency, operating ability, growth ability, and cash flow ability based on SPSS software, and constructed a financial risk evaluation system using factor analysis method [11]. Liu Zhiqin(2024) studied corporate financial risks in the context of big data and conducted a double-sided analysis of big data. He not only affirmed the advantages of big data in financial risk management, but also pointed out the problems that exist in this area [12]. Liu Xiaoi(2024) and others used the Z-score model to evaluate the financial risks of Zhonggong Education Group and provided corresponding risk response suggestions[13]. The Z-score model was originally proposed by Altman in 1968 and was first used to analyze the financial risks of manufacturing enterprises [3]. Liu Xiaoi modified its relevant weights to make it more in line with the commercial characteristics of the education and training industry, proving the plasticity and accuracy of the model.

Based on the research results of domestic and foreign scholars mentioned above, this article will use the Z-score model to evaluate and analyze the financial risks of China's real estate industry. Greenland Holdings Group Co, Ltd (hereinafter referred to as "Greenland Group") was established in 1992, headquartered in Shanghai, and has since expanded its business scope to more than 50 countries worldwide. As one of the top 500 state-owned enterprises in the world with a billion-yuan level, Greenland Group has been exposed to debt default in recent years, reflecting the significant financial risks within the group. For example, at the end of October 2022, Greenland Group issued an announcement stating that it was unable to repay the outstanding \$362 million notes due on November 13 and had advanced notice of default; On the evening of January 30, 2024, Greenland Group expected to achieve a net profit attributable to the owners of the parent company of -7 billion to -9 billion yuan in 2023, a year-on-year decrease of 793.07% to 991.09% compared to 2022.

Therefore, this article selects Greenland Group as the research object, evaluates its financial risk status and proposes relevant feasible suggestions that help Greenland Group reduce overall financial risk, providing reference for real estate enterprises.

2. Relevant Concepts and Theoretical Foundations

2.1. Financial risk

The concept of financial risk is mainly based on the mean-variance theory and expected utility theory. The mean-value variance theory is proposed by Harry Markowitz, which points out that there is a trade-off between the expected return and risk of the investment portfolio, and the goal of maximizing the expected return or minimizing risk can be achieved through a reasonable allocation of the asset portfolio [14]; the expected utility theory is proposed by John von Neumann and Oskar Morgenstern, which points out that when decision-makers are faced with uncertainty, they have to make a decision, which states that decision makers consider not only expected return and risk, but also personal preferences and utility functions when facing uncertainty [15].

Financial risk is a multidimensional and complex concept that can be understood in a broad or narrow sense. Financial risk in a broad sense refers to the risk that an enterprise will face potential losses in the course of its operations due to the impact of a variety of unpredictable factors such as changes in the market environment, policy adjustments, technological innovation, etc., which leads to the uncertainty of the financial situation and thus exposes the enterprise to potential losses. This kind of risk not only covers the internal capital operation links such as financing, investment, operation and income distribution, but also involves the external environmental factors such as market risk, credit risk, exchange rate risk, and so on. The broad financial risk has a wide coverage, aiming to comprehensively reveal the various types of risks that may be encountered in the process of enterprise operation [16].

Comparatively speaking, the narrow sense of financial risk focuses mainly on the risks in debt treatment and operational activities of enterprises, especially the financing risks due to excessive debt burden or poor operation, such as the inability to repay debts on time and the break of the capital chain [17]. The narrow sense of financial risk focuses more on analyzing the challenges and dilemmas of enterprises in the financing process, and its scope of concern is relatively limited.

Therefore, this paper identifies the financial risks faced by Greenland Group in the process of operation based on the perspective of financial risk in the broad sense and controls the financial risks from a broader perspective.

2.2. Z-score model theory

The Z-score model is a financial early warning model constructed using a multivariate statistical approach. The multivariate statistical method enables the model to consider multiple financial indicators, such as profitability, solvency, operational efficiency, etc., to reflect the financial health of the enterprise in a more comprehensive and multidimensional way. The Z-score model, proposed by Altman (1968), takes the bankrupt enterprise as a sample, and through the use of statistical methods such as multivariate linear discriminant analysis, analyzes and calculated by applying statistical methods such as multivariate linear discriminant analysis, a comprehensive discriminant score - Z-score is finally obtained. Z-score reflects the financial status and bankruptcy risk of an enterprise, which can be used as an important reference for decision-making by investors, creditors and other stakeholders. The formula is as follows:

$$Z = 1.2 \times X_1 + 1.4 \times X_2 + 3.3 \times X_3 + 0.6 \times X_4 + 0.999 \times X_5 \quad (1)$$

Where: X_1 = Working Capital/Total Assets

X_2 = Retained Earnings/Total Assets

X_3 = EBIT/Total Assets

X_4 = Owner's Equity/Total Liabilities

X_5 = Sales Revenue/Total Assets

The X_1 indicator can accurately assess the activity of the enterprise's cash flow and effectively reflect the actual turnover speed of each asset. This indicator has a positive relationship with the liquidity of the enterprise's assets, the higher the value of the indicator, the stronger the liquidity of

the enterprise's assets. X_2 indicator reflects the ability of the enterprise's operating profit to withstand financial risks, the larger the value of the indicator, meaning that the enterprise has a stronger ability to withstand the risks. X_3 indicator is able to intuitively show the production scale and strength of the enterprise's assets, the larger the value of the indicator, meaning that the enterprise's production capacity is stronger. X_4 indicator can measure the relationship between the liabilities borne by the enterprise and its overall value, the larger the value of the indicator, the stronger the solvency of the enterprise. X_5 indicator for the total return on assets, as a comprehensive indicator, comprehensively reflecting the enterprise's utilization and management efficiency of all the assets, reflecting the extent to which the assets have been realized in the process of sales, the higher the value of the indicator, the better the efficiency of enterprise's utilization of assets and asset management efficiency.

According to the research of scholars at home and abroad, the Z-Score model can effectively measure the degree of enterprise financial risk, and the size of the value is inversely proportional to the degree of enterprise financial risk. However, because the Z-score model is not fully applicable to listed companies in China, the critical value of the Z-score model of Ma Dongjun (2023), the critical value of the Z-score model is improved[18], and the specific improvement criteria are shown in Table. 1.

When $Z \leq 0.9241$, the enterprise belongs to the crisis type, the enterprise's financial situation is extremely poor, facing a serious financial crisis, and financial risk is significant, in the bankruptcy zone.

When $0.9241 < Z < 1.8771$, the enterprise belongs to the risk type, the enterprise's financial situation is uncertain, in the gray area, if not to improve the operating conditions and financial situation is a greater financial risk.

When $Z \geq 1.8771$, the enterprise belongs to the robust type, the enterprise's financial status is better, the financial risk is smaller, and it is in the safe zone.

Table. 1.Criteria for judging Z-value

Interval Dividing	Interval Rating	Evaluation
$Z \leq 0.9241$	Bankruptcy Zone	Crisis
$0.9241 < Z < 1.8771$	Gray Zone	Risky
$Z \geq 1.8771$	Security Zone	Robust

3. Case selection explanation

3.1. Overview of Greenland Group

Greenland Holdings Group Co, Ltd (hereinafter referred to as "Greenland Group") was established in 1992, with its headquarters located in Shanghai. Since its establishment, Greenland Group has undergone multiple rounds of institutional and mechanism reforms, with the overall trend of more diversified equity and more market-oriented, public, and internationalized institutional mechanisms. Especially after the Third Plenary Session of the 18th Central Committee, Greenland further deepened the reform of mixed ownership and completed its overall listing in 2015, becoming a typical case of mixed ownership reform. Up to now, its business scope has spread to more than 50 countries around the world, forming a comprehensive business pattern with real estate and infrastructure as the main businesses, and coordinated development of industries such as finance, consumption, health, and science and technology innovation. And since 2012, Greenland Group has been included in the Fortune Global 500 list for 9 consecutive years, ranking 176th in 2020, reaching a new historical high.

3.2. Explanation of case selection for Greenland Group

The article selects Greenland Group as the research object. On the one hand, Greenland Group has a huge volume and is at the forefront of the real estate industry. At the same time, the development scale, product types, and quality brands of its main business in the real estate industry are all in a leading position, which has had a broad and far-reaching impact on China's urban and rural construction and real estate development. Therefore, selecting the industry leader Greenland Group

as the research object has a certain representativeness. On the other hand, in recent years, there has been a constant stream of news about the real estate industry's thunderstorms, exposing the enormous financial risks of the industry. As one of the top 500 state-owned enterprises in the world, Greenland Group is no exception. For example, at the end of October 2022, Greenland Group issued an announcement stating that it was unable to repay the outstanding \$362 million notes due on November 13 and had advanced notice of default; On the evening of January 30, 2024, Greenland Group expected to achieve a net profit attributable to the owners of the parent company of -7 billion to -9 billion yuan in 2023, a year-on-year decrease of 793.07% to 991.09% compared to 2022. From this, it can be seen that Greenland Group has a high risk of debt default, and the owner's equity belonging to the parent company cannot be guaranteed, resulting in significant financial risks. Therefore, overall, this article chooses Greenland Group as the research object, which is both representative and typical, and also has a certain warning effect.

4. Financial risk analysis of Greenland Group

4.1. Solvency analysis

Table. 2. shows five financial indicators of Greenland Group from 2015 to 2022, which reflect the Group's debt paying ability. For the real estate industry, maintaining a current ratio of around 2 and a quick ratio of around 1 is a relatively normal state [19]. However, from Table. 2., it can be seen that the current ratio and quick ratio of Greenland Group have been significantly lower than their respective industry standard values of 2 and 1 from 2015 to 2022, and the current ratio has shown a continuous downward trend, dropping from 1.54 in 2015 to 1.08 in 2022. This indicates that Greenland Group's short-term solvency is low and constantly weakening. After analysis, the reasons are as follows: (1) Greenland Group's excessive use of advance payment sales policies has led to a significant increase in short-term liabilities, a significant decrease in current ratio, and weak short-term solvency; (2) Greenland Group's management of working capital is inefficient, with a long cash cycle, resulting in a shortage of cash flow. As a result, it heavily borrowed short-term liabilities, leading to a significant decrease in current ratio and a low and continuously weakening short-term solvency. If the current ratio continues to maintain this trend, it will fall below 1 in the future, and Greenland Group's current assets will be insufficient to repay its current liabilities, leading to a significant increase in debt risk. The quick ratio slightly decreased in 2015 and 2016, from 0.41 to 0.40; Afterwards, there was a slight increase in 2017 and 2018, reaching 0.43 and 0.44 respectively, but in 2019 it fell to the same level as in 2015, which was 0.41; Afterwards, there was a relatively significant increase in the quick ratio in 2020, from 0.41 to 0.49, an increase of 19.5%. This is also the highest quick ratio achieved by Greenland Group from 2015 to 2022, but still far below 1; The quick ratio of Greenland Group maintained a level of 0.45 in 2021 and 2022. This indicates that Greenland Group's short-term solvency is weak. After analysis, the main reason is that Greenland Group has excessively expanded its business scale, borrowed a large amount of money, and incurred high interest expenses, resulting in difficulties in capital turnover and weak short-term debt repayment ability.

The asset liability ratio, net debt ratio, and cash to short-term debt ratio in Table. 2. constitute the "three red lines" for measuring the financial risk of real estate companies. That is, for financially normal real estate companies, the asset liability ratio after deducting prepayments should not exceed 70%; The net debt ratio shall not exceed 100%; The cash to debt ratio shall not be less than 1 times. However, in 2015, the asset liability ratio of Greenland Group was 88.04%, which slightly increased to 89.43% in 2016; Afterwards, it declined again in 2017, dropping to 88.99%. In 2018, the asset liability ratio rose to 89.49%, which is the highest asset liability ratio achieved by Greenland Group from 2015 to 2022. The asset liability ratio has remained at a relatively high level from 2019 to 2022. Although it slightly decreased to 78.61% in 2021, it is still above the safety warning line of 70% for the asset liability ratio. This indicates that Greenland Group has a high proportion of assets provided by creditors, high debt risk, tight funding chain, and weak overall debt repayment ability. After

analysis, this is due to Greenland Group borrowing huge amounts of debt to support infrastructure projects with high funding needs, resulting in a large proportion of assets being composed of liabilities and an overall weak debt paying ability.

The net debt ratio reflects the relationship between the owner's equity and debt level of the enterprise. But in 2015, Greenland Group's net debt ratio reached 280.76%, which is 2.8 times the "red line" limit for net debt ratio, and it increased to 294.59% in 2016. From 2017 to 2020, although the net debt ratio of Greenland Group decreased from 210.53% to 135.10%, it remained above the industry warning line of 100%. In 2021, Greenland Group's net debt ratio saw a significant decrease, from 135.10% to 90.72%, a decrease of 32.85%, falling below the "red line" of 100% for asset liability ratio. In 2022, the net debt ratio slightly decreased compared to 2021, dropping to 89.60%. This indicates that the overall financial condition of Greenland Group was poor from 2015 to 2020, especially from 2015 to 2017 when its interest-bearing liabilities exceeded owner's equity by more than two times, posing significant financial risks and having extremely weak debt repayment ability. Although the net debt ratio has maintained a downward trend from 2017 to 2020, it is still above 100%, indicating weak debt repayment ability; In 2021 and 2022, the financial situation has improved, and the debt repayment ability has slightly strengthened but remains weak. After analysis, the main reasons for the change in Greenland Group's net debt ratio are as follows: (1) Greenland Group issued a large scale of perpetual bonds from 2018 to 2020, reaching 2 billion yuan, resulting in a high debt ratio and low proportion of owner's equity, so the net debt ratio of Greenland Group was high, leading to weak overall debt paying ability; At the end of 2020, Greenland Group paid off all perpetual bonds and did not issue any further perpetual bonds in 2021 and 2022. The portion of owner's equity attributable to the parent company increased, the net debt ratio decreased, and the overall debt paying ability slightly improved but still remained relatively low; (2) The infrastructure projects of Greenland Group occupy a large amount of monetary funds and have slow capital flow. They cannot be repaid when short-term debts mature and can only choose to extend, resulting in a significant increase in accrued interest expenses and weak overall debt repayment ability; (3) The COVID-19 has had a disastrous impact on China's real estate sales, investment and construction activities. On the one hand, since a series of measures of regular epidemic prevention and control put restrictions on crowd gathering activities and other arrangements, real estate enterprises cannot deliver their houses; On the other hand, reasons such as extended holidays, delayed resumption of work, and quarantine requirements may also lead to a delay in the construction period, indirectly causing real estate companies to be unable to deliver their properties on time. Therefore, a group of real estate companies, including Greenland Group, are unable to timely collect and transfer income according to the contract, and have to pay huge interest expenses, ultimately leading to a significant reduction in monetary funds, a significant increase in net debt ratio, and overall weak debt repayment ability.

The cash to short-term debt ratio can be used to measure the ability of real estate companies to repay short-term interest-bearing liabilities in a timely manner. If it is lower than 1, it indicates that the company has insufficient cash to repay short-term liabilities and there is a significant risk of bankruptcy liquidation. Table. 2. shows a summary of the solvency indicators of Greenland Group from 2015 to 2022. It can be seen that the cash to short-term debt ratio of Greenland Group remained at 0.66 in 2015 and 2016, and then increased significantly in 2017, reaching 0.81, an increase of 22.72%. This is also the highest cash to short-term debt ratio achieved by Greenland Group from 2015 to 2022. In 2018, Greenland Group's cash to short-term debt ratio was 0.79, which slightly decreased to 0.70 in 2019; Afterwards, it returned to the same level in 2020 as in 2018; In 2021 and 2022, the cash to short-term debt ratio of Greenland Group continued to decline, dropping from 0.63 to a historic low of 0.44, a decrease of 30.16%. It can be seen that the cash to short-term debt ratio of Greenland Group has been consistently below the industry warning value of 1 from 2018 to 2022. In 2022, monetary funds have been severely insufficient, and its short-term solvency is weak and continuously weakening. After analysis, this is due to the inefficient collection of accounts receivable and notes receivable by Greenland Group, which has led to slow cash flow and continuous borrowing

of new debt, resulting in a significant decrease in the cash to debt ratio and a significant weakening of short-term solvency, posing significant financial risks.

Table. 2. List of solvency indicators of Greenland Group from 2015 to 2022

Year Financial ratio	2015	2016	2017	2018	2019	2020	2021	2022
Current ratio	1.54	1.45	1.32	1.24	1.22	1.20	1.12	1.08
Quick ratio	0.41	0.40	0.43	0.44	0.41	0.49	0.45	0.45
Asset liability ratio	88.04%	89.43%	88.99%	89.49%	88.53%	88.89%	78.61%	87.97%
Net debt ratio	280.76%	294.59%	210.53 %	175.04%	158.00 %	135.10%	90.72%	89.60%
Cash to short-term debt ratio	0.66	0.66	0.81	0.79	0.70	0.79	0.63	0.44

4.2. Operational capacity analysis

Table. 3. List of Greenland Group's operating capacity indicators from 2015 to 2022

Year Financial Indicators	2015	2016	2017	2018	2019	2020	2021	2022
Accounts receivable turnover (times)	12.97	12.71	8.95	6.92	5.65	4.78	5.00	3.86
Accounts receivable turnover days (days)	27.75	28.72	40.78	52.75	64.6	76.36	73.00	94.56
Inventory turnover (times)	0.48	0.48	0.50	0.53	0.57	0.56	0.64	0.54
Inventory turnover days (days)	747.00	760.42	730.00	688.68	640.35	651.79	570.31	675.93
Fixed Assets Turnover Ratio (times)	15.51	18.50	20.24	14.63	10.51	7.88	8.58	6.91
Total Assets Turnover Ratio (times)	0.37	0.37	0.37	0.37	0.39	0.36	0.38	0.31

The accounts receivable turnover ratio measures the efficiency of the company's accounts receivable into cash, reflecting the ability to collect accounts, the higher the indicator, the lower the operational risk. As can be seen from Table. 3., the accounts receivable turnover ratio of Greenland Group decreases from 12.97 times to 4.78 times between 2015 and 2020, rises slightly to 5.00 times in 2021, but decreases sharply to 3.86 times in 2022, and the overall accounts receivable turnover ratio of Greenland Group shows a decreasing trend, reflecting the weakening of Greenland Group's operating ability. Corresponding to the accounts receivable turnover ratio, the accounts receivable turnover days reflects the average number of days it takes for a company to start generating accounts receivable until it finally collects the cash. The accounts receivable turnover days of Greenland Group increased from 27.75 days in 2015 to 94.56 days in 2022, which indicates the weakening of Greenland Group's operating ability as a result of the slower recovery of accounts receivable, the decrease in available funds and the increase in financial risk. Upon analysis, the reasons were as follows: (1) due to the decrease in sales of building materials in 2022, Greenland Group's operating revenue of RMB435.5 billion decreased by 19.98% year-on-year, which resulted in Greenland Group's merchandising realizing revenue of RMB17.2 billion, a decrease of 32% year-on-year, which in turn affected accounts receivable turnover ratio and accounts receivable turnover days, and the operating capacity was weakened; (2) due to the recurrence of the epidemic exceeding the expectation and the spread of large area, the prolonged closure and control, which seriously affected the normal production and operation of Greenland Group; at the same time, the economic downturn exceeded expectations, the contraction of demand and the supply shock made the upstream and downstream

parties in the real estate and infrastructure industry seriously lack of confidence, and the market Yuanqi suffered a large damage, which indirectly affected the recovery of the accounts receivable of the Greenland Enterprises, the turnover rate of the accounts receivable and the number of days of turnover of the accounts receivable, which ultimately resulted in the weakening of the Greenland Group's operating capacity.

The inventory turnover ratio indicates the average number of times that an enterprise's inventory undergoes the entire process from acquiring cost to realizing sales revenue in a specific period, which measures the turnover speed and utilization efficiency of the enterprise's inventory and can intuitively show the company's inventory management efficiency. As can be seen in Table. 3., between 2015 and 2020, the inventory turnover ratio increased from 0.48 times to 0.57 times, followed by a small decline to 0.56 times in 2020; by 2021, the inventory turnover ratio had a significant increase to 0.64 times, but then declined to 0.54 times in 2022. This indicates that overall Greenland Group's inventory turnover ratio is unstable, reflecting a weakening of operating capacity. Corresponding to the inventory turnover ratio, the inventory turnover days indicates the average number of days it takes for a company's inventory to go from warehousing to final sale. Greenland Group's inventory turnover days decreased from 747.00 days in 2015 to 570.31 days in 2021, indicating that the speed of inventory turnover improved during the period; however, the inventory turnover days rebounded to 675.93 days in 2022, which is almost close to the 688.68 days of inventory turnover days in 2018, further indicating that Greenland Group's operating capacity has weakened. Upon analysis, the reasons for the decrease in inventory turnover ratio and increase in inventory turnover days of Greenland Group in 2021-2022 were mainly due to the impact of the epidemic on the progress of the start-up and delivery of the enterprise, superimposed on the fact that the Company, or in order to quickly reduce the debt ratio, scaled down part of the funds for the start-up of the construction works, which led to the Greenland Group realizing a contracted sales area of 5,892,000 sq.m. in 2022, representing a year-on-year decrease of 9.5%, which ultimately led to a weaker operating capacity of Greenland Group.

The fixed asset turnover ratio measures the efficiency of an enterprise's use of fixed assets, i.e. the number of times each unit of fixed assets of an enterprise can be turned over in a year. A higher fixed asset turnover ratio means that the enterprise can effectively utilize fixed assets for production and sales activities, thus improving the efficiency of asset use. From Table. 3, the fixed asset turnover ratio of Greenland Group decreased from 15.51 times in 2015 to 6.91 times in 2022, which indicates that Greenland Group's efficiency in the use of fixed assets decreased, and the fixed assets are not fully and effectively utilized, which indicates that Greenland Group's operating capacity is weak.

Total asset turnover is a measure of the efficiency with which an enterprise utilizes its total assets to generate sales revenue. The level of this indicator reflects the efficiency of the enterprise's asset management as well as the effectiveness of asset investment. As shown in Table. 3, from 2015 to 2022, the total asset turnover ratio of Greenland Group shows an overall decreasing trend, from 0.37 times in 2015 to 0.31 times in 2022, indicating that Greenland Group's asset management has declined, and its operating capacity has weakened. Upon analysis, the reasons are as follows: (1) Since 2019, Greenland Group has always insisted on pursuing an expansionary development strategy and is keen on constructing high-rise buildings, however, the construction of high-rise buildings is not only costly, but also has a long construction cycle; the current market for high-rise apartment buildings and high-rise office buildings is not optimistic, mainly in terms of the imbalance between supply and demand and the frustration of market confidence. In terms of supply and demand, there is an oversupply of properties in some cities; at the same time, due to the continuous decline in the marriage rate and the birth rate, as well as the aging of the population and the change of the new generation's concepts of purchasing properties, the demand for purchasing properties is gradually decreasing, and this imbalance of supply and demand has negatively impacted the market of high-rise apartment buildings and high-rise office buildings, and the Greenland Group's operating income has been affected, and its operating capacity has been weakened. In terms of market confidence, the frequent occurrence of problems such as the misappropriation of pre-sale funds by developers and the suspension of

construction work in recent years has undermined the confidence of home buyers, and although the government is making efforts to maintain social stability and rebuild public trust through measures such as "guaranteed delivery", it will take time for market confidence to recover. The market downturn affected the operating income of the Greenland Group and weakened its operating capacity. (2) Greenland Group was in a period of transition. Under the influence of the national macro-control policy, the credit policy and debt collection policy of Greenland Enterprises were adjusted, which indirectly affected the fixed asset turnover rate and the total asset turnover rate, and ultimately led to the weakening of Greenland Group's operating capacity.

4.3. Profitability analysis

Table. 4. List of Profitability Indicators of Greenland Group from 2015 to 2022

Year Financial ratio	2015	2016	2017	2018	2019	2020	2021	2022
Net sales margin	3.56%	3.80%	4.68%	4.60%	4.90%	4.64%	1.73%	1.06%
Return on net assets	11.10%	12.59%	15.88%	15.84%	17.44%	14.75%	5.92%	2.80%

Profitability is the ability of an enterprise to obtain profits, which is the key to measuring the development strength of an enterprise, and profitability analysis is an important content in financial analysis, the net sales interest rate reflects the ability of an enterprise to obtain operating profits in a certain period of time, and the return on net assets reflects the ability of an enterprise to utilize its net assets to create profits. According to the data in Table. 4., it can be seen that Greenland Group's profitability in 2015-2020 is rising as a whole, but Greenland Group's net sales margin plummets from 4.64% in 2020 to 1.73% in 2021 and continues to fall to 1.06% in 2022; Greenland Group's return on net assets plummets from 14.75% in 2020 to 5.92% in 2021 and continues to fall to 2.80% in 2022. Greenland Group's net sales margin and return on net assets both plummet from 2021, indicating that Greenland Group's profitability has significantly weakened from 2021 onwards. Upon analysis, the main reasons for Greenland Group's weaker profitability in 2021 are as follows:(1) Affected by the Epidemic, Greenland Group's contracted order book plummeted in the first half of 2020, with a contracted sales amount of only RMB133,029 million, a decrease of 20.7% compared with the same period in 2019. On the basis of the lower contracted sales amount in 2020, the contracted amount in the first half of 2021 was only 164.074 billion yuan, realizing an increase of only 23.34%. This resulted in weakened profitability of Greenland Group. (2) Since 2020, Greenland Group's land acquisition scale has continued to decline. For example, in the first half of 2021, Greenland Group's land acquisition amount and land acquisition area ranked lower among the TOP100 real estate enterprises, at 23rd and 15th respectively, indicating Greenland Group's weakened profitability.

5. Z-score model financial risk indicator analysis

In this paper, Z-score model is chosen to assess the financial health of Greenland Group. Based on the Z-score model proposed by Altman (1968), the values of Greenland Group's financial indicators for 2015-2022 are calculated as shown in Table. 5.

Table. 5. Greenland Group X_1 - X_5 Financial Indicator Values from 2015 to 2022

Year Financial ratio	2015	2016	2017	2018	2019	2020	2021	2022
X_1	0.3178	0.2842	0.2201	0.1739	0.1601	0.1456	0.0924	0.0644
X_2	0.0508	0.0478	0.0482	0.0472	0.0505	0.0461	0.0454	0.0495
X_3	0.0229	0.0235	0.0201	0.0273	0.0314	0.0252	0.0170	0.0117
X_4	0.0230	0.0186	0.0161	0.0131	0.0120	0.0098	0.0098	0.0117
X_5	0.3452	0.3371	0.3420	0.3361	0.3734	0.3262	0.3705	0.3190

Based on the data, the situation of each indicator is analyzed. Indicator X_1 =Working Capital/Total Assets, reflecting the liquidity and distribution of enterprise assets, the value of X_1 indicator of Greenland Group has decreased by 79.74% from 2015 to 2022, the liquidity of Greenland Group's assets is weakened, which indicates that Greenland Group's capital turnover is not working well or there is a short-term debt repayment crisis. Indicator X_2 =Retained Earnings/Total Assets, reflecting the level of cumulative profitability of the enterprise, in the period of 2015-2022 the value of indicator of Greenland Group is at a low level of about 0.05, indicating that Greenland Group's operating conditions are not very satisfactory, profitability is weaker, and the ability to withstand risks is lower. Indicator X_3 = EBIT/Total Assets, reflecting the production capacity of enterprise assets, the larger the value, the better the utilization of enterprise assets, but the value of Greenland Group's X_3 indicator starts to fall below 0.02 in 2021, which indicates that Greenland Group's management level is declining, and its operating capacity is weakening. Indicator X_4 =Owner's equity/Total Liabilities, reflecting the relationship between the value of the enterprise and its debt, i.e., whether the basic financial structure of the enterprise is reasonable or not, according to the value in Table.5, the value of X_4 indicator of Greenland Group has been decreasing since 2015, indicating that the solvency capacity of Greenland Group is weak, facing high risk of bankruptcy. Indicator X_5 =Sales Revenue/Total Assets, reflecting the utilization effect of enterprise assets, the higher the indicator, indicating that the higher the utilization rate of enterprise assets, the higher the indicator, the lower the value of X_5 indicator than any year 2015-2021, indicating that Greenland Group's efficiency of asset utilization is reduced, and the operating capacity is weakened.

Based on the value of X_1 - X_5 calculated above, the value of each indicator is substituted into the Z-score model, i.e. $Z = 1.2 \times X_1 + 1.4 \times X_2 + 3.3 \times X_3 + 0.6 \times X_4 + 0.999 \times X_5$, which results in the Z-value of Greenland Group for the period of 2018-2022 as shown in Table.6, and the change of the Z-value is as shown.

Table. 6.List of Z-values for Greenland Group from 2015 to 2022

Year	2015	2016	2017	2018	2019	2020	2021	2022
Z-value	0.89	0.83	0.75	0.71	0.75	0.65	0.61	0.51

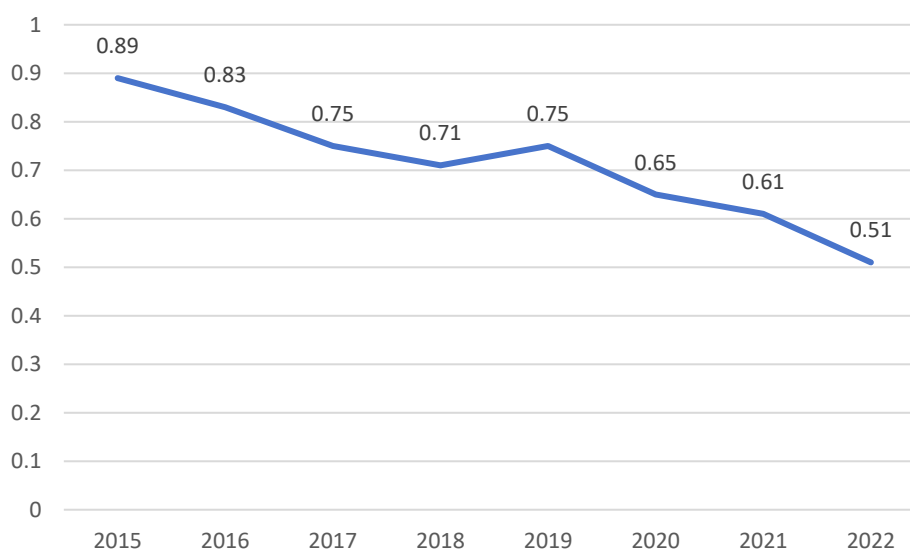


Figure 1. Change in Z-value for Greenland Group from 2015 to 2022

According to the Z-value shown in Table.6 and the change of Z-value in Figure 1 and analyzed with the Z-value judgment standard. The Z-value of Greenland Group from 2015 to 2022 has been lower than 0.9241, Greenland Group is in the bankruptcy zone, and the overall Z-value is decreasing from 0.89 in 2015 to 0.51 in 2022, with poor financial condition and high financial risk, which belongs to the crisis type enterprise.

6. Financial risk control suggestions and countermeasures for Greenland Group

6.1. Strengthen working capital management and shorten cash cycle

From the previous analysis, it can be seen that Greenland Group's management of working capital is inefficient, and the collection period of accounts receivable and inventory turnover days are long, resulting in a long cash cycle and insufficient daily cash flow, which cannot support Greenland Group's daily operating activities. Therefore, Greenland Group should strengthen its management of working capital, appropriately shorten the account receivables period given to customers, or attract customers to make payments as soon as possible through cash discounts, in order to accelerate the collection of account receivables. At the same time, Greenland Group should regularly evaluate the aging of account receivables, and take necessary collection measures for account receivables that are about to expire or have a short overdue period; For accounts receivable with a long overdue period, Greenland Group should consider whether to classify them as bad debts and write them off. Finally, it is necessary to regularly review the credit status of customers. For customers with poor credit, lower credit limits should be given, while strengthening the collection of accounts receivable; For customers with good credit status, the limit on credit sales can be appropriately relaxed to promote consumption and increase income. In addition to strengthening the collection of account receivables, Greenland Group should also enhance its ability to "eat upstream", that is, Greenland Group should choose high-quality suppliers, establish long-term partnerships, and strive for a longer payment period for account payables; Secondly, Greenland Group should optimize its inventory structure and procurement plan, avoid excessive procurement, reduce inventory backlog, and thereby improve inventory turnover rate.

6.2. Establish a risk response mechanism and improve risk response capabilities

Due to the lack of a sound risk response mechanism, the normal production and operation of Greenland Group suffered a huge blow during the significant economic downturn caused by the epidemic, resulting in a significant decrease in sales and facing significant financial risks. To prevent financial risks caused by unexpected events and improve risk response capabilities, Greenland Group should establish a professional risk response team and adjust its business model in a timely manner when risks arise, in order to minimize losses. Secondly, Greenland Group should establish a risk culture within the company, embed risk awareness into company policies, and strengthen the awareness of risk identification; On the other hand, Greenland Group can strengthen its internal control system, clarify the responsibilities and obligations of all parties, and establish a sound accountability system. Finally, Greenland Group should also strengthen process management and truly prevent risks in advance, review them during the process, and summarize them afterwards.

6.3. Strengthen advance receipts management and avoid blind expansion

Due to the expansion-oriented development strategy adopted by Greenland Group, which has undertaken a large amount of business, the number of advance payments remains high. Therefore, the enterprise needs to do a good job in the management of advance payments. For high-risk orders, Greenland Group should do corresponding risk response work and establish sufficient risk reserves. At the same time, Greenland Group should classify and manage advance receipts, distinguishing between different types of advance receipts such as advance deposits and advance payments, in order to facilitate follow-up and avoid management confusion. Secondly, Greenland Group should establish a sound internal control system to avoid the misappropriation and abuse of prepaid income; On the other hand, Greenland Group should regularly verify and clean up advance receipts, timely transfer income, and ensure the accuracy of advance receipts and income. Finally, due to the current sluggish market for high-rise apartments and office buildings, demand has decreased. Greenland Group should reduce its acceptance of such contract orders and focus on the construction of small units to quickly overcome the transformation period.

6.4. Optimize capital structure and reduce financial leverage

Due to the high debt ratio and capital cost in Greenland Group's assets, it is urgent for Greenland Group to optimize its capital structure, increase its equity ratio, and reduce its financial leverage. Firstly, due to the lower cost of internal financing compared to external financing, Greenland Group can prioritize internal financing by using retained earnings accumulated over the years for financing. This method can raise a portion of funds without increasing financial leverage. Secondly, Greenland Group can increase its equity ratio by issuing new shares or issuing right issues, attract new shareholders or attract existing shareholders to make additional investments, thereby reducing its debt ratio and financial leverage. Finally, Greenland Group can also establish a dynamic investment portfolio, which is adjusted appropriately according to changes in market conditions, maximize investment returns, and use the investment returns to repay debts and reduce financial leverage.

7. Conclusions

In order to study the financial risk of the real estate industry, this paper chooses Greenland Group as the research object, takes Greenland Group's annual report data from 2015-2022 as the research sample, uses the financial analysis method and Z-value analysis method, analyzes Greenland Group's financial risk, explores the reasons for the financial risk, and puts forward feasible suggestions to reduce the degree of financial risk in a targeted manner.

Through the financial analysis of Greenland Group, it is concluded that the capital structure of Greenland Group is unreasonable, exceeding the "three red lines" of financial risk in the real estate industry, with weak solvency; the turnover rate of accounts receivable, inventory turnover, fixed asset turnover, and the turnover rate of total assets are all on a downward trend, with weakened operating capacity; at the same time, the net sales interest rate and the return on net assets have all declined, and the net profit margin has been reduced, with a decrease of the net profit margin. Net sales margin and return on net assets all declined, weakening profitability. The reason is mainly due to the expansion of the scale of debt, inefficient working capital utilization and management, and lower sales affected by the epidemic, etc. The Z-score model further concludes that the financial situation of Greenland Group is not optimistic, and the average Z-value of Greenland Group for 2015-2022 is 0.71, which is much lower than 0.9241, and is in the bankruptcy zone, which belongs to the crisis-type enterprise.

Real estate enterprises face diverse risk challenges, and if they cannot effectively control these risks, they are very likely to make strategic mistakes in future business decisions. Based on the results of the traditional financial risk analysis and Z-value analysis of Greenland Group, this paper puts forward the following feasibility suggestions: (1) In addition to paying close attention to the market dynamics and grasping the changing market information in real time, real estate enterprises should strengthen their working capital management and shorten the cash circulation cycle; (2) establish a risk response mechanism to improve their own risk resilience; (3) strengthen the management of advance receipts, avoid blind expansion; (4) optimize the capital structure and reduce financial leverage. Aiming at the financial risks faced by real estate enterprises, only by optimizing and adjusting their business strategies can they better adapt to market changes and ensure long-term and stable development.

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