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Research article

Research on Risks in Corporate Issuance of Green Bonds: A Case Study of Three Gorges Group

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ABSTRACT

With China entering a new era of green, low-carbon, and circular development, the green economy has emerged as a powerful force driving economic transformation. Within this realm, green bonds have increasingly captured the market's attention. This paper adopts a case study approach, focusing on the Three Gorges Group's issuance of green convertible bonds. It examines the details and motivations behind the group's issuance, analyzes its short-term excess yield and long-term debt repayment, operational, and profitability capabilities. Furthermore, the study evaluates risks faced by the Three Gorges Group in issuing green bonds, including interest rate, credit, liquidity, and policy risks. Based on these findings, the paper provides recommendations and insights to guide other enterprises and investors, offering valuable experience in this field.

Key words: Three Gorges Group; green exchangeable bonds; financial analysis; risk analysis; Z-score

1. Introduction

With the gradual improvement of people's requirements for ecological environment, green finance, as a new financial tool, has made great progress in credit, bonds, funds and other fields. At the national level, the construction of the green financial system was first put forward in China at the end of August 2016. The People's Bank of China and seven other ministries and commissions jointly issued the Guiding Opinions on Building a Green Financial System, which clearly defines the connotation of the green financial system. This measure shows the importance China now attaches to the development of green finance. In November 2019, the People's Bank of China released the China Green Finance Development Report (2018), showing that new achievements and progress have been made in the development of green finance. By the end of 2018, the balance of green credit in banking financial institutions nationwide was 8.23 trillion yuan, up 16% year on year, with an increase of 1.13 trillion yuan, accounting for 14.2% of the increase in loans to enterprises and other units in the same period. In December 2023, China Green Finance Practice Innovation and Development Report: 2023 China has become the world's largest green credit market and the second largest green bond market, by the end of the third quarter of 2023, the balance of green loans is 28.58 trillion yuan, a year-on-year growth of 36.8%, ranking the first in the world; the domestic green bond market balance 1.98 trillion yuan, ranking the second in the world; from the enterprise level, the rise of green finance marks the enterprise to the commitment to sustainable development, and provides a new channel of financial support for environment-friendly projects. In this context, green bonds, as one of the important financial instruments to promote sustainable development, are increasingly concerned and favored by enterprises and investors.

The issuance of green bonds helps companies raise funds for environmental projects, while also committing to a range of environmental standards and guidelines. Among the various forms of green bonds, exchangeable bonds, as a bond instrument with flexibility and special nature, provide more financing options for enterprises. However, the risks and impacts of companies issuing green exchangeable bonds are a topic of great concern.

The purpose of this study is to discuss the case of "G Three Gorges EB1" issued by the Three Gorges Group, and analyze the risk factors and challenges behind it. As a leading clean energy and hydropower company in China, the Three Gorges Group is typical and important as a case. The risks faced by the group when issuing green exchangeable bonds are not only related to the company's own financial situation, but also related to investors' confidence and evaluation of green financial products.

2. Concept introduction

2.1 Green finance

Green finance refers to the economic activities to support environmental improvement, climate change and efficient use of resources, that is, the financial services provided for project investment and financing, project operation and risk management in the fields of environmental protection, energy conservation, clean energy, green transportation, green building and other fields. The definition includes the following meanings: first, the purpose of green finance is to support environmentally efficient projects, Environmental benefits include supporting environmental improvement, responding to climate change and making efficient use of resources; Second, the main categories of green projects are given, This is good for the future of various green financial products, For example, the definition and classification of green credit, green bonds, green stock index and so on have important guiding significance; Third, it is clarified that green finance includes financial services that support green project investment and financing, project operation and risk management, It shows that green finance does not only include financing activities such as loans and securities issuance, Also includes risk management activities such as green insurance, It also includes a carbon finance business with multiple functions.

2.2 Green bonds

Green bonds refers to will raise funds dedicated to support the requirements of the green industry, green projects or green economic activities, issued in accordance with legal procedures and the agreed servicing securities, including but not limited to green financial bonds, green corporate bonds, green corporate bonds, green debt financing instruments and green asset-backed securities.

2.3 Exchangeable Bonds

Exchangeable bonds are bonds issued by the issuer, which pledge their shares in the listed company, and stipulate to exchange the shares of the issuer in the listed company under certain conditions in a certain period in the future. In this way, investors in exchangeable bonds can buy stocks and make a profit between the market price and the trading price. Exchangeable bonds are generally used as financing instruments for not publicly traded companies with shares of listed companies, while convertible bonds are generally used as financing instruments for publicly traded companies that mortgage their own shares. Exchangeable bonds have the characteristic of stocks, namely that under certain conditions they can be converted into stocks in the future.

3. Case introduction

3.1 Company Profile

China Three Gorges Corporation (China Three Gorges Corporation Co., LTD.) is a state-owned enterprise in China, founded on September 27,1993, headquartered in Yichang city, Hubei Province. As a national core competitiveness and backbone enterprise, the group conducts business in the fields of hydropower, port and navigation, finance and real estate. Under the strong leadership of the CPC Central Committee and The State Council, after 30 years of continuous, rapid and high-quality development, the Three Gorges Corporation has become the world's largest hydropower development and operation enterprise and a leading clean energy group in China, and has become one of the first world-class demonstration enterprises identified by the State-owned Assets Supervision and Administration Commission of the State Council.

In addition to hydropower, the company also has several subsidiaries in new energy, finance and design consulting and services fields. The group actively participates in economic construction and environmental protection at home and abroad through its subsidiaries of Yangtze River Electric Power, Three Gorges Finance, Shanghai Survey, Design and Research Institute and Three Gorges International Energy Investment Group.

Three gorges group is based on the new stage of development, complete, accurate, fully implement the new development concept, build a new development pattern, promote the development of high quality, strive to implement clean energy and the Yangtze river ecological environmental protection "wings", "difference" period will be built a world-class clean energy group and domestic leading ecological environmental protection enterprises, to achieve carbon peak, carbon neutral goal, promote economic and social development comprehensive green transformation to make greater contributions.

3.2 Issuance situation

Yangtze river three gorges group in 2019 public offering green exchangeable corporate bonds "G EB1" the three gorges, bond issuance for 5 years, due in 2024, issue coupon rate of 0.5%, bonds payable once A year, the bonds at the price of one hundred yuan each, A total issuance of two hundred million pieces, raise money to achieve twenty billion yuan, and in the Yangtze river power A shares as collateral. According to the rating conclusion issued by China Chengxin Securities Evaluation Co., Ltd., the rating conclusion subject and the debt have obtained the highest AAA rating, which indicates that the issuer has a strong ability to repay debt, is basically unaffected by the adverse economic environment, and the default risk is very low; the credit quality of this bond is extremely high and the credit risk is extremely low.

4. Issue motivation

4.1 Response to national policies

In March 2017, China's China Securities Regulatory Commission issued the Guidelines on Promoting the Construction of Environmental Securities, aiming to lead the construction of the environmental bond market, promote the sustainable growth of green industries, simplify the approval procedures of environmental corporate bonds, and significantly shorten the financing period, so as to improve environmental quality. Green bond is an efficient and fast financing method, which can effectively promote enterprises to achieve green development. On September 22,2020, General Secretary Xi Jinping announced at the 75th Session of the United Nations General Assembly that China's carbon dioxide emissions will strive to peak by 2030, and strive to achieve carbon neutrality by 2060. Over the past three years, our country actively promote the "double carbon" work, and to the central committee of the communist party of China under the State Council on complete and accurate fully implement the new development concept of carbon peak carbon neutral opinion and carbon 2030 years ago peak action plan as guidance, build carbon peak carbon neutral "1 + N" system, make important contributions to the global environmental protection enterprise.

Yangtze river three gorges group as a clean energy group and the leading domestic ecological environmental protection enterprises, actively response to the country's green development policy, pay attention to green production, group issued green bonds "G EB1" three gorges than ordinary bonds in green project financing, for the Yangtze river three gorges group in green development road increase power.

4.2 Meet the capital needs

Yangtze river three gorges group as a large enterprise, for the implementation of large-scale environmental protection and sustainable development projects will have capital needs, at the same time from the Yangtze river three gorges group in 2019, the group total liabilities reached 415.3 billion, and the surplus reserves and undistributed profits of only 69.4 billion yuan, combined with the green project wu east Germany, crane beach hydropower station construction need at least 14 billion yuan. So before issuing green bonds, the Yangtze river three gorges group capital demand, if you go to the bank loan, not only approval process, loans down slower, and bank lending rates are higher than the rate of green bonds, so green bonds for the Yangtze river three gorges group provides a new financing channels, and green projects belong to the scope of green bonds support, conform to the basic conditions of issuing green bonds. By issuing green bonds, the Group is able to raise funds specifically for environmental protection projects, and improve the sustainability and professionalism of the funds to support the long-term development of the enterprise and the realization of its goals.

4.3 Improve the company's reputation

As a state-owned enterprise, the Three Gorges Group has been following the footsteps of the country and paying attention to its corporate social responsibility. In recent years, the group active service the Yangtze river economic belt development and other national major national strategy, in the depth into the Yangtze river economic belt, catch the Yangtze river play a key role in the main protection, in promoting the regional sustainable development, in promoting clean energy industry upgrading and drive China's hydropower "going out" leading responsibility, promote the enterprise deepen reform and innovation and development, speed up built with strong innovation ability and global competitiveness of the world-class multinational clean energy group.

The issuance of green bonds is a manifestation of enterprises' active social responsibility. More and more investors pay attention to environmental responsibility and social responsibility investment. These investors not only pursue investment returns, but also care about the environmental impact of their investment. Through issuing green bonds, the Yangtze river three gorges group to investors showed their positive action, deepened the investors recognition of the group and trust, improve the Yangtze river three gorges group brand image in the heart, improve the issuers of green reputation, is conducive to the future financing needs, for the green development of the enterprise.

5. Financial analysis

5.1 Short-term financial analysis

When a major event, the stock price will be widely concerned by investors, when the major event sends a positive signal, and the investors feel that the news can have a positive effect on the value of the company, or the investors are optimistic about the news, will make the decision to buy the stock price rise; on the contrary, if the investors negative the news, the company's stock price will fall. Therefore, in this paper, the underlying stock of "G Three Gorges EB1" bond, is selected as the research object.

On April 9,2019, The Three Gorges Group issued a 20 green exchangeable bond of 20 billion yuan, and took Yangtze Power Company as the underlying stock. Company issued large-scale bonds is an important node of its development, so choose April 9,2019 as the base date of event research, the window period in the event base date [-10,10], event estimated date for base [195,15] -1, a total of 180 days, to analyze the expected returns, excess returns and cumulative excess returns of the company's stock.

First, the market model is constructed (1) to predict the return rate of each share.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_i \quad (1)$$

$R_{i,t} R_{m,t} \alpha_i \beta_i \hat{R}_{i,t}$ It represents the real yield of i company at time t; it represents the market yield. The model (1) regresses the samples in the estimated period, and then calculates the expected return rate of the stock price during the window period, namely the model (2); the difference between the actual rate of return and the expected return rate is the abnormal return rate of i company; the cumulative sum of the abnormal rate of return in the window period is the cumulative excess return rate obtained by the investors.$AR_{i,t}$ （$AR_{i,t} = R_{i,t} - \hat{R}_{i,t}$） CRA_i （$CRA_i = \sum AR_{i,t}$）

$$\hat{R}_{i,t} = \alpha_i + \beta_i R_{m,t} \quad (2)$$

Through regression analysis and calculation, we can see that the excess rate on the day of the release of the day of the bond is negative, and the three days after the day of the overall excess rate after the bond is an inflection point, after two days of short recovery, and then quickly fall, indicating that the issuance of green bonds has a positive effect on the stock price is limited, and investors believe that the release of the bond will not have a positive impact on the value of the company.

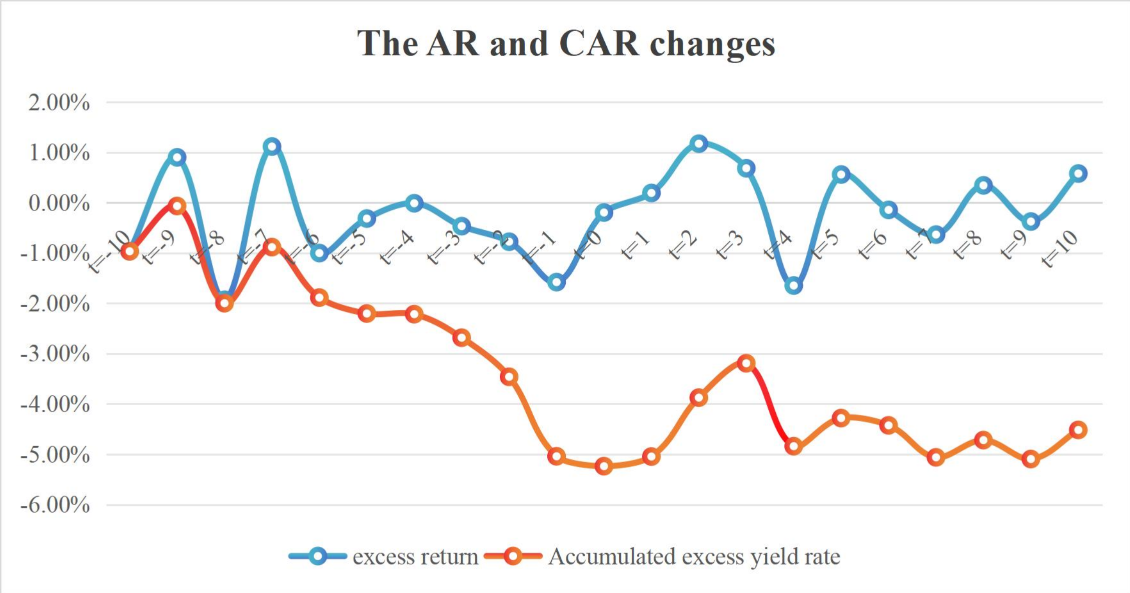


Figure 1 Changes of AR and CAR of Yangtze River Electric Power

The issuance of green exchangeable bonds has not significantly improved the short-term stock value, but the green reputation value brought to the issuer based on the green debt financing signal will increase. By issuing green bonds, we can give the public a message that the company is a positive response to sustainable development and "two-carbon" policy, which can establish a good image in the whole society and promote the rise of the company's stock price in the long term.

5.2 Long-term financial analysis

5.2.1 Operating conditions

As shown in Figure 2, from 2018 to 2022, the enterprise operating income increased year by year, and the operating growth rate always remained positive, reaching the peak of 23.82% in 2021. By 2022, the operating revenue of enterprises had reached 146.26 billion yuan, an increase of 5.75% year on year, and the revenue was relatively stable.

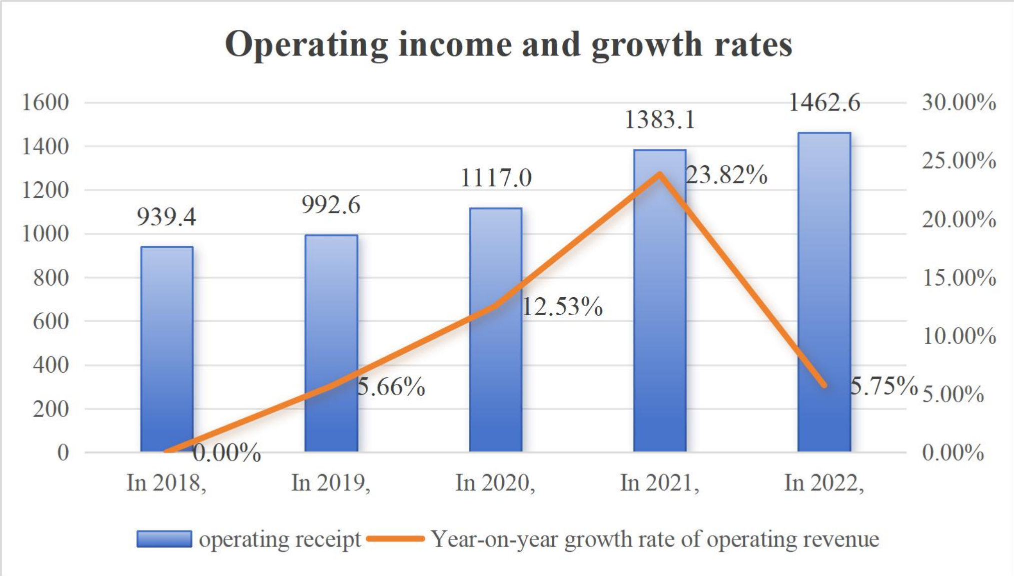


Figure 2 Operating revenue and growth rate from 2018 to 2022

As the main business of Yangtze Three Gorges Group, its power sales revenue accounts for more than 80%. From 2018 to 2022, its revenue has increased steadily. By 2022, the power sales revenue of Three Gorges Group has reached 117.05 billion yuan.

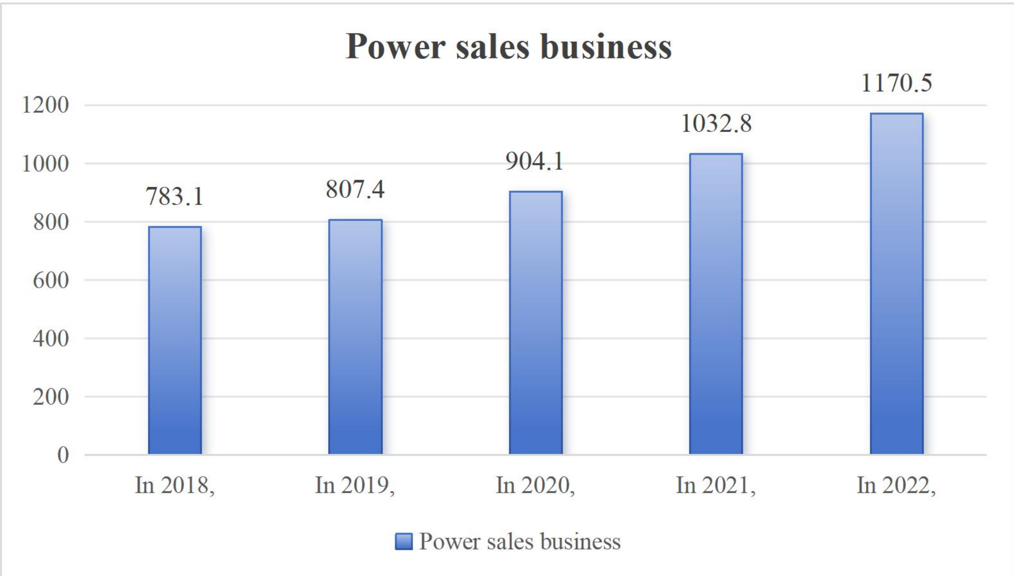


Figure 3 Electricity sales business revenue in 2018-2022

It can be seen that the enterprise has a relatively extensive and in-depth layout in the field of electric power business, and its main business performance is steady and continuous growth trend. This trend not only brings stable earnings to the company, but also proves the company's dominant position and competitive strength in the power industry. With the continuous promotion of national policies and requirements in the adjustment of energy consumption structure, environmental protection and sustainable development, the enterprise is expected to continue to maintain stable growth in the future and actively expand hydropower, wind power and other new energy fields.

5.2.2 Insolvency analysis

As shown in Figure 4, this paper selects the current ratio and the quick ratio to measure the short-term solvency of the Three Gorges Group. Before the issuance of carbon neutral bonds, the current ratio and quick ratio of the Three Gorges Group increased first and decreased later, and the current ratio and quick ratio changed in 2018 and 2019 in 2020 to 0.56 and 0.55. After the issuance of carbon neutral bonds in 2021, the current ratio and quick ratio rose substantially, at 0.74 and 0.73 respectively, with the recovery of more than 30%, and exceeding the pre-declining ratio in 2019. Therefore, from the perspective of short-term solvency, the issuance of carbon neutral bonds by the Three Gorges Group can improve the company's short-term solvency.

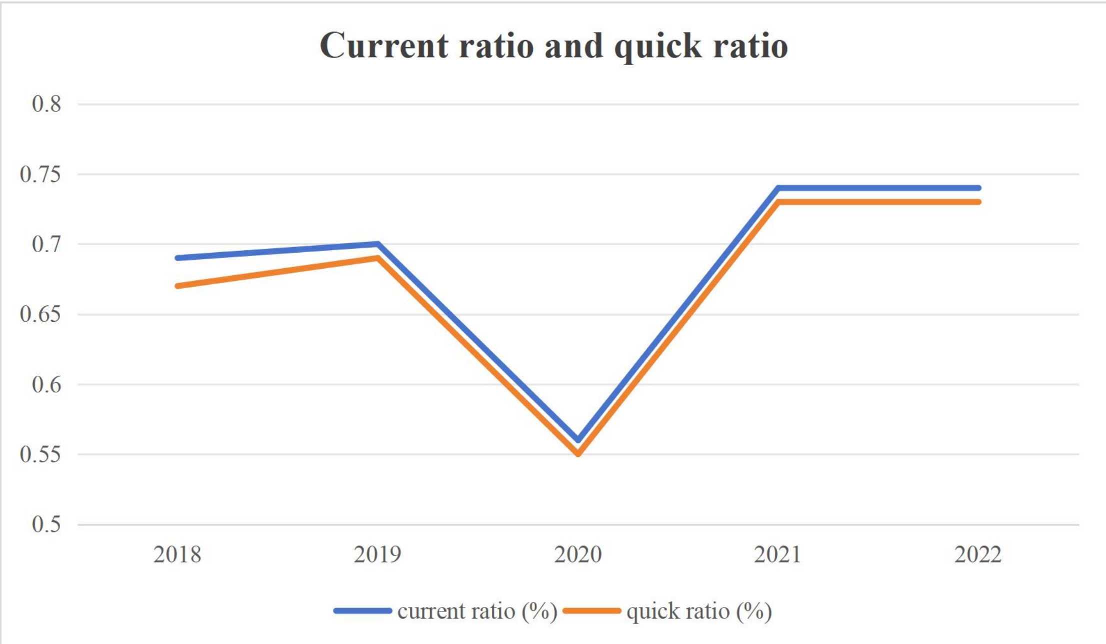


Figure 4 Change of current ratio and quick ratio from 2018 to 2022

As shown in Figure 5, this paper uses the EBITDA interest guarantee multiple index to measure the long-term solvency of the Three Gorges Group. The EBITDA interest guarantee multiple of The Three Gorges Group showed a trend of declining first and then rising later before the issuance of carbon neutral bonds. After the issuance of carbon neutral bonds, the EBITDA interest guarantee multiple decreased from 5.4 in 2020 to 4.9, indicating that the guarantee degree of the company's profitability on debt repayment decreased. Therefore, from the perspective of long-term solvency, the issuance of carbon neutral bonds by the Three Gorges Group brings some pressure to the company's long-term debt repayment.

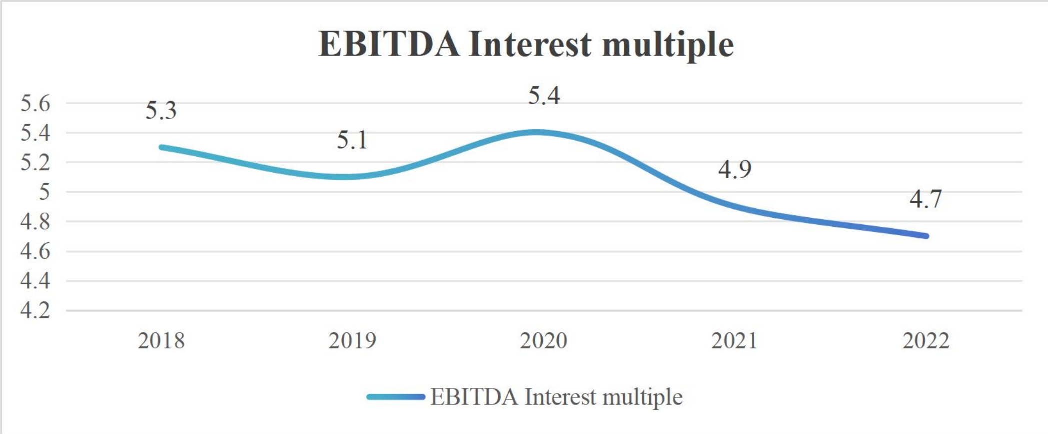


Figure 5 Change of EBITDA from 2018 to 2022

5.2.3 Operation capacity analysis

As can be observed from the data in Table 1 that from 2018 to 2020, due to the increasing number of projects under construction of the Three Gorges Group, the total asset turnover rate of the company decreased from 0.13 to 0.12 times. After the issuance of carbon neutral bonds, it rebounded to 0.13 times in 2021, indicating that the total asset turnover speed is accelerated, and the sales capacity of the Three Gorges Group has been enhanced. In recent years, the inventory turnover rate of The Three Gorges Group has shown an overall upward trend, increasing from 26.30 times to 56.1 times, indicating that the company's sales capacity has become stronger, the inventory realization speed is faster, and the capital occupation level is lower. In 2020, the inventory turnover growth rate of The Three Gorges Group is 3.8%, and after the issuance of carbon neutral bonds, the inventory turnover growth rate is 4.7%, and the growth rate has increased.

Due to the increase in electricity charges of Yangtze River Electric Power and Three Gorges Energy, subsidiaries of the Three Gorges Corporation, as well as the increase in the general contracting business of China Hydropower Company and Shanghai Survey and Research Institute, the receivables of the Three Gorges Corporation have been increasing in recent years, and the turnover rate of accounts receivable has decreased. After the issuance of carbon neutral bonds, the receivables turnover rate of the Three Gorges Group in 2021 was 4.15 times, still continuing the previous downward trend.

Table 1 Operating Capacity Index for 2018-2022

	In 2018,	In 2019,	In 2020,	In 2021,	In 2022,
Total asset turnover rate (time / year)	0.13	0.12	0.12	0.13	0.12
Inventory turnover rate (second / year)	31.40	38.10	39.54	41.39	56.1
Accounts receivable turnover rate (time / year)	5.85	4.98	4.76	4.15	2.95

5.2.4 Profitability analysis

As shown in figure 6, this paper selects the return on equity to measure corporate profitability, data can be observed from the figure, the company's return on equity in small fluctuations, in 2020 reached 10.10%, the highest but falling in nearly three years, the return on equity in 2022 is only 7.40%, which shows that the enterprise's own capital gain earnings in recent years is weak, lower operating efficiency, to the enterprise investors, creditors.

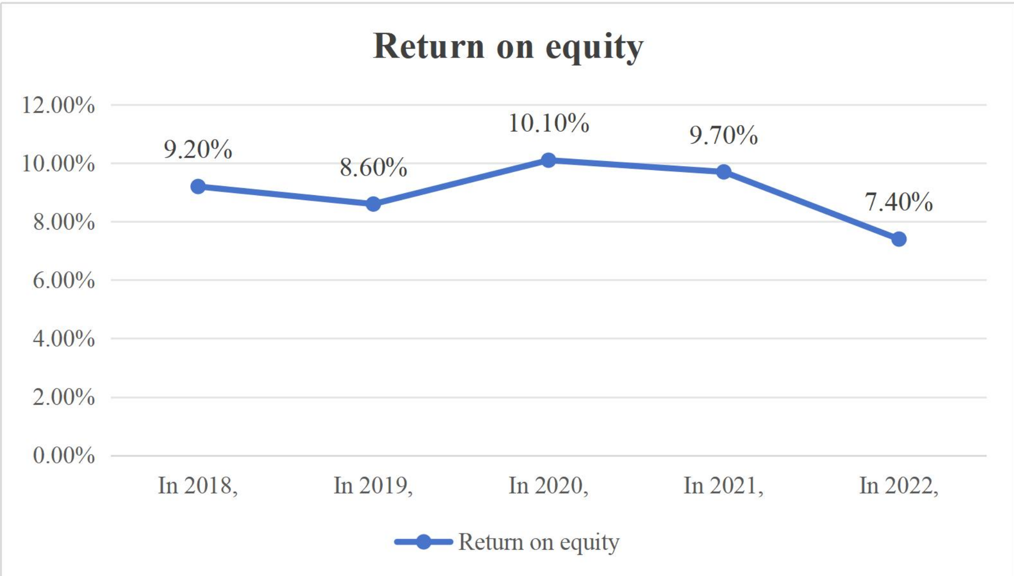


Figure 6 Changes of return on equity from 2018 to 2022

As shown in Figure 7, this paper selects the net interest rate of sales to measure the profitability of the company. As can be seen from the data in the figure, although the net interest rate of sales of the company changed slightly from 2018 to 2021, it basically remained between 36% -40%, and reached the highest value of 40.64% in 2020. Similar to its return on equity, Three Gorges's net interest rate on sales fell in 2022 to a five-year low of 29.08%. This reflects that the income level of the company's sales revenue remained high between 2018 and 2021, but the income level of sales revenue decreased in 2022, and the appreciation level of corporate capital decreased.

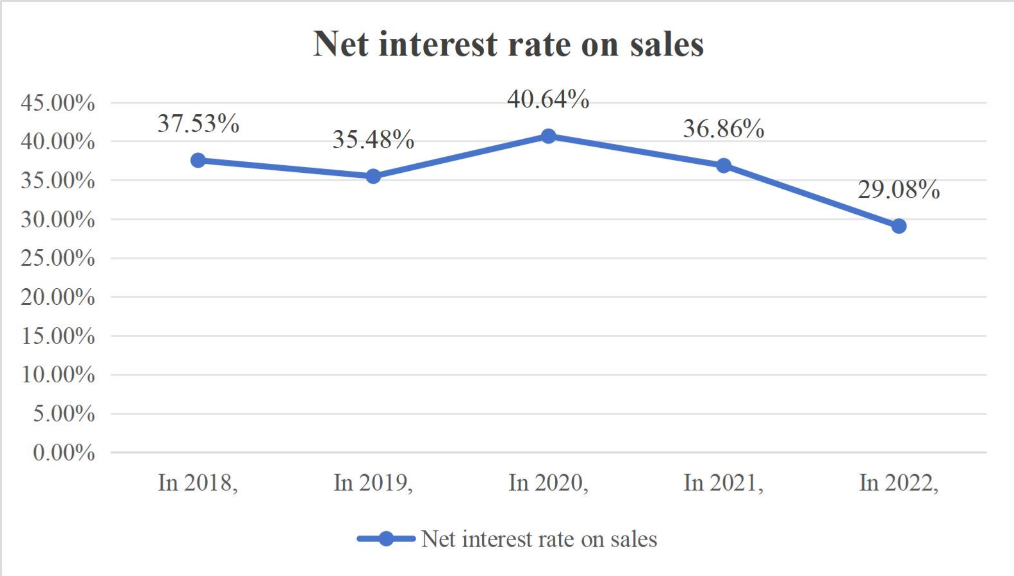


Figure 7 Changes in the net interest rate of sales from 2018 to 2022

Through the above financial analysis, we can find that in the short term, the issuance of green exchangeable bonds does not bring a positive effect on the stock of Changjiang Electric Power, but the excess returns decline in the long term, although the company is increasing year by year, we can know that the solvency, turnover and profitability of assets and receivables are decreasing, and the operation is at risks.

6. Risk analysis

After the above financial analysis, we found that after the issuance of green exchangeable bonds, the production and operation face a series of risks. Therefore, we will carry out the risk analysis of enterprises issuing bonds from four aspects of interest rate, credit, liquidity and policy.

6.1 Interest rate risk

The interest rate of a bond is usually fixed at the time of issuance, and the interest rate of the bond issuer set at the time of issuance is not affected by changes in market interest rates. But, on the one hand. Because the green bond adopts the form of fixed interest rate, has a long maturity and may span multiple economic cycles, the fluctuation of market interest rate may make investors face the uncertainty of bond price changes. At the same time, the fluctuation of market interest rate may bring about the reduction of exchange rights, and bring more risks to the investors of green exchange bonds. Therefore, the value of the exchangeable green bonds is inversely proportional to the interest rate, and the change of the interest rate has a double impact on the green exchangeable bonds, which is greater than the ordinary stocks or bonds.

Investors in green exchangeable bonds need to consider the risks of changes in market interest rates.

So here, we use the formula of effective duration with the help of effective duration and effective convexity.

$$D = \frac{P_- - P_+}{2\Delta y P_0}$$

$$D = \frac{P_- + P_+ - 2P_0}{\Delta y^2 P_0}$$

Where Δ y represents the value of the change of the yield to maturity, the value is 0.1%, P represents the current value of the securities, and P-and P + represent the value of the securities when the yield to maturity falls or rises by 0.1%, respectively. At the same time, this paper selects the five-year green bonds with the same credit rating issued at the same period as "19 Emerging Green Bonds 01" to calculate the effective convexity and effective duration of these bonds.

Table 2. Effective Duration and effective convexity of similar bonds

Bond referred to as	Release time	interest rate	P_-	P_+	Effective duration	effective convexity
G Three Gorges EB1	2019-04	0.5%	100.4940556	99.5088755	4.92	14.65
19 Emerging green debt 01	2019-01	4.25%	100.4489592	99.55356437	4.42	12.36
G19 Oasis 1	2019-05	2.8%	100.4619201	99.54071872	4.60	13.19
G19 Guangzhou Railway 1	2019-01	3.9%	100.4476946	99.55481777	4.46	12.56
G19 LuGang 1	2019-04	5.2%	100.4317535	99.57061932	4.30	11.86

The maturity of the bonds selected in the above table is the same, so the data reflecting the effective duration is between 4 and 5, and the difference is not very big. The effective duration and effective convexity of "G Three Gorges EB1" are both very high, indicating that the interest rate risk level of the bond is high, which may be related to the issued interest rate. During the duration of this bond, the market interest rate is more likely to fluctuate. At the same time, because the green bonds in the form of fixed interest rate, longer term, may across multiple economic cycle, the market interest rate fluctuations may make investors face the uncertainty of bond price changes, for investors need to have a clear consciousness of these fluctuations, to try to avoid the investment risk brought about by the sharp changes.

6.2 Credit risk

Since the issuer of this bond is a non-listed company, this paper uses the Z-Score credit model to calculate the credit risk of the current bond and compare it with the existing credit rating, so as to have a warning effect on the credit risk of this green exchangeable bond. According to the credit assessment report of China Chengxin International in recent years, the Three Gorges Group has a good credit rating, the credit rating is the highest AAA, and is able to pay the principal and interest in time. In the past three years, it has not defaulted on any transactions with its main customers, and intends to adhere to the principle of good faith operation in future business activities and strictly abide by the contracts, agreements and other commitments. In general, the Three Gorges Group has high profitability and low credit risk.

Z-score model was proposed by Altman Financial scholars in 1968. It is a system based on the multivariate statistical method and the sample of bankrupt enterprises to analyze and judge the operating status and bankruptcy of enterprises through a large number of experiments. The basic equation of this model is as follows:

$$Z = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.999X_5$$

Table 3 Z-score, information table of model indicators

metric	formula	concrete content
X1	Working capital / total assets	Reflect the short-term financial situation of the enterprise, that is, the liquidity of current assets
X2	Retained earnings / total assets	Reflect the ability of enterprises to obtain income in the future
X3	EBITDA / total assets	Reflects the ability of an enterprise to generate profits from its operating activities
X4	Equity market value / total liabilities	It reflects investors' confidence in the financial strength of enterprises
X5	Operating income / total assets	Reflect the ability of enterprises to manage assets

Data source: collated according to the public information

This model is often used to analyze the likelihood of a company to default, by calculating the Z value of a company in successive years to determine whether the company is at risk of bankruptcy. When Z is greater than or equal to 2.6, there is no financial problem; when Z value is greater than 1.1 and less than 2.6, it is in a gray area, with fluctuating financial situation and high probability of bankruptcy; when Z value is less than or equal to 1.1, it means that the company is close to bankruptcy and the financial situation is very bad.

The following table is the Z-value calculated by collecting and analyzing the financial statements of The Three Gorges Corporation from 2018 to 2022. The results are shown in the following table:

Table 4 The Z-value early warning situation of the Three Gorges Group

Time (year)	Factor decomposition of the (%)					Z value score	The Z-value results are described
	X1	X2	X3	X4	X5		
2018	-4.5415	7.3743	6.8499	111.529	12.4083	1.0679	Worry about
2019	-4.207	8.2991	6.1963	101.7091	11.7597	0.9979	Worry about
2020	-7.2098	9.7575	6.6083	96.9317	11.4526	0.9642	Worry about
2021	-4.2869	10.1041	6.3495	151.8986	11.7344	1.2858	Worry about
2022	-4.0243	10.1302	5.3497	92.5214	11.4935	0.9696	Worry about

Data source: based on the calculation

As shown in the table above, the Group's debt levels increased over the five-year period from 2018 to 2022 and X1 was consistently negative, consistent with the Group's assertion that hydro working capital is low and negative working capital will lead to working capital deficit and short-term cash flow difficulties. The increase in X2 over the previous year indicates the group's tendency to use its retained earnings to fund its business, which is consistent with the priority financing argument. The X4 decreased from 111.529% in 2018 to 96.9317% in 2020, indicating that investor confidence in the group's financial ability has declined year by year, which improved in 2021 but continued to decline in 2022. The values of X3 and X5 have both stabilized at a relatively stable value in the past five years, indicating that the group will maintain a relatively stable profitability and generate sufficient revenue each year to fund its continuous operations. The results of Z-score model show that the default risk and credit risk are higher.

6.3 Liquidity risk

Bond liquidity risk refers to the risk that bonds cannot change hands in time and make investors suffer losses. From 2016 to 2022,2,325 green domestic bonds were issued in the market, with a scale of 2,592.799 billion yuan. Among them, 668 green bonds will be issued in 2022, with an issuance scale of 861.202 billion yuan. It exceeded the 800 billion yuan mark for the first time. Since 2016, the issuance of domestic green bonds has continued to rise, and in 2022, the total amount of domestic green bonds issued in that year exceeded 800 billion yuan. Investors in the bond market have a large number of bonds to trade, indicating that the bond issuance market is more liquid. In recent years, the central bank has further introduced interest rate cuts, and investors' demand for bonds, including the demand for green bonds, will further increase, thus increasing the liquidity of the bond market.

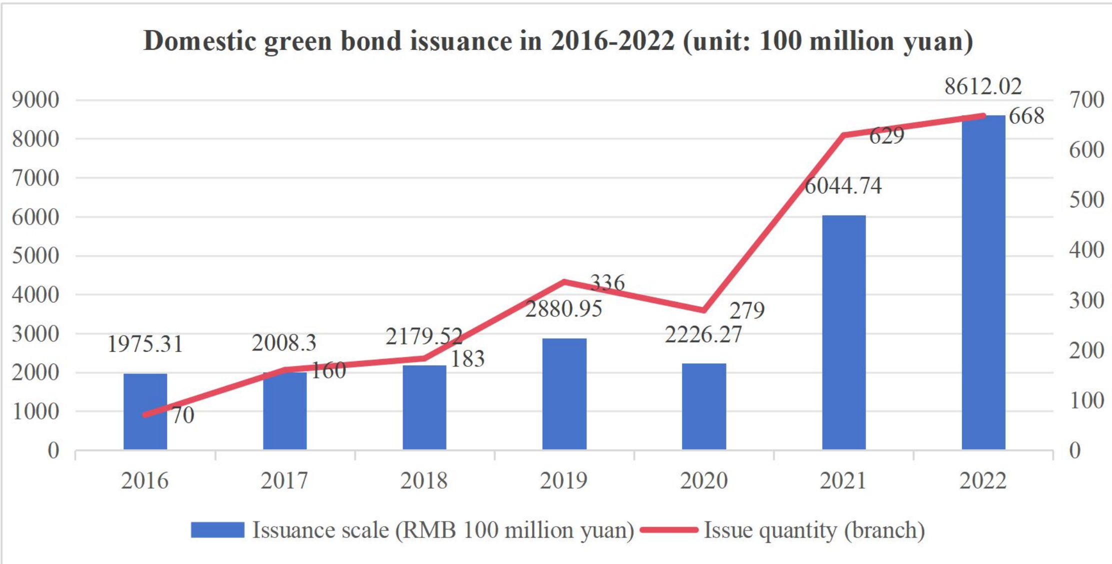
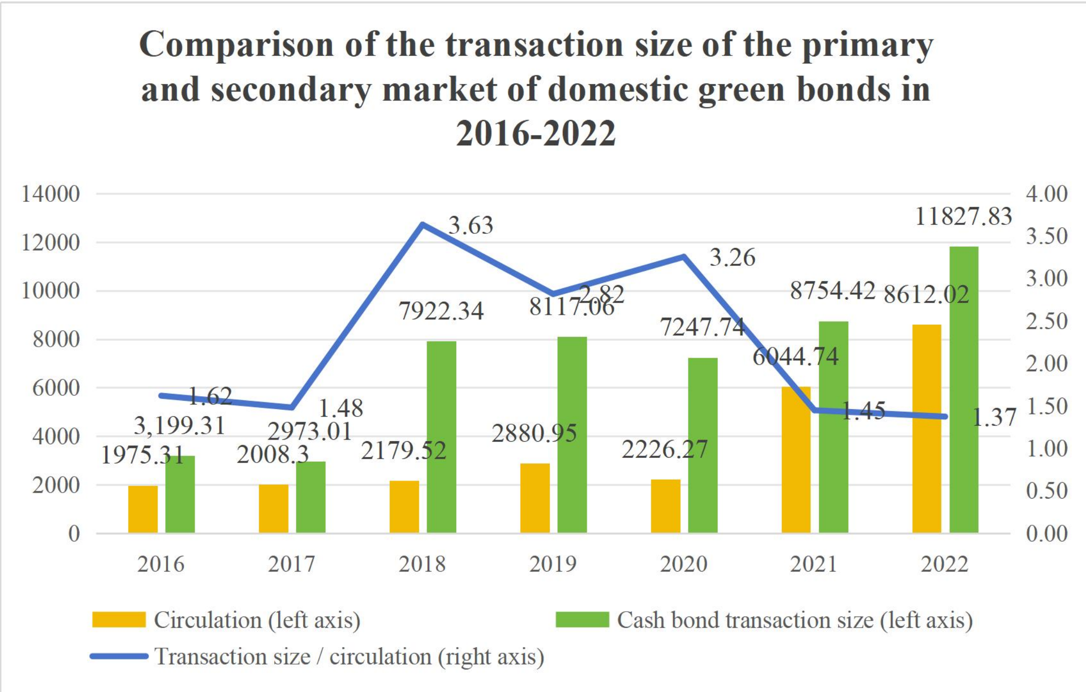


Figure 8 Domestic green bond issuance in 2016-2022

Data source: wind, China Bond network, China Money network, Anrong Rating collation

Although the issuance of the bond market and the green bond market is rising, it only shows that the liquidity of green bonds in the primary market is good. Below is the green bonds in the secondary market trading active quantity to analyze the green bond liquidity risk can be seen, in 2016 and 2017 domestic green bond volume, respectively, 319.931 billion yuan, 297.301 billion yuan, the two years domestic green bond volume is low, but the rapid growth in 2018 to 79292.234 billion yuan, green bond volume produced significant growth. The broken line represents the ratio of the transaction volume of all kinds of green bonds to the total amount issued from 2016 to 2022, reached the highest point in 2018, and then showed a downward trend of volatility. The growth rate of green bond issuance is higher than the growth rate of trading volume in the secondary market, which indicates that the trading activity of green bond cash bond is not high and there is a large investment risk. China's domestic green bond market is still in a period of scale expansion, the scale of the primary market is growing rapidly, and the secondary market still needs to be cultivated.



Data source: Sina Finance

Figure 9 Comparison of the transaction scale of the primary and secondary market of domestic green bonds in 2016-2022

6.4 Policy risks

6.4.1 Environmental protection risks

In view of the construction and operation of hydropower stations will have a certain impact on the ecology and environment of the reservoir area and the river basin, the state attaches great importance to the impact of hydropower projects on the ecological environment and the protection of the ecological environment. On January 1,2015, the new environmental protection law was implemented, and the continuous improvement of the domestic environmental protection policy requirements may increase the investment expenditure and operating cost of the power station construction of the issuer.

6.4.2 Policy risks of wind power equipment industry

The subsidiary of the issuer is holding the wind power equipment manufacturing enterprises. The development and profitability of the wind power industry are more dependent on the national policy and regulatory framework to support the development of wind power. Although the state has repeatedly reiterated that it will continue to strengthen the support for the development of the wind power industry, the possibility of its change or abolition of preferential measures and favorable policies cannot be ruled out. Changes in future national policies on the wind power industry may affect the financial situation of the subsidiaries of the issuer.

6.4.3 Policy risks of green bonds

In terms of green bond policy risks, we should pay special attention to the change of policy provisions on green bond financing access rules, Green bonds are still immature, Many supporting policies, laws and regulations are not yet sound, So there was no uniform standard for issuing green bonds before, With the "China Green Bond Principles" released by the Green Standards Committee in July 2022, Green bond development has taken a solid step forward, The policy rules have also changed, among, The proportion of the use of green bonds raised funds has been revised, before, The National Development and Reform Commission and the Shanghai and Shenzhen stock exchanges allow companies to use part of the raised funds to supplement their working capital, The China Green Bond Principles require all the raised funds to be invested in green projects, Government regulation of green bonds is also becoming increasingly strict. The national green debt standards are gradually in line with international standards, which is conducive to foreign investors' investment in domestic green bonds. Therefore, compared with ordinary bonds, enterprises issuing green bonds are more easily affected by policy risks, and the increase of risks will directly affect the price of bonds.

On December 8,2023, China Securities Regulatory Commission and the State-owned Assets Supervision and Administration Commission of the State Council jointly issued the Notice on Supporting Central Enterprises to Issue Green Bonds. Three Gorges Group is a central enterprise under the management of the State-owned Assets Supervision and Administration Commission of the State Council. The notice provides financing convenience for central enterprises to issue green bonds, which is conducive to the development of enterprises. At the same time, optimize the supervision and evaluation of intermediaries, and strengthen the supervision of issuers and intermediaries, which may increase the risks of issuing enterprises.

6.4.4 Risk of electricity price approval

The on-grid electricity price of the issuer's power stations in the future shall be approved by the national competent authorities. If the approved electricity price does not match the investment expenditure and actual operating cost of the issuer, and the preferential tax and financial policies cannot be obtained, it will have a certain impact on the business performance of the issuer.

7 Suggestions and Revelations

7.1 Suggestions for the Yangtze River Three Gorges Group

First, we will improve the risk management mechanism of green bonds and innovate the yield methods of green bonds. Yangtze river three gorges group as a green bond issuers, although there are relevant risk control department to assess the risk of possible prediction, but it has not yet established special green bond risk prevention and management mechanism, quantitative assessment and preventive measures have not been fully established, so there are still strong potential risk, which leads to the market for the larger potential risk of the new green bond acceptance is not high. If an enterprise cannot build a sound risk management mechanism to control the risks related to green bonds, once the risks explode, it will cause incalculable negative impact on enterprises, investors and even the whole financial market. Therefore, the relevant enterprises in the green bond industry should establish a relatively complete quantitative risk management mechanism of green bonds, improve the level of quantitative risk analysis of green bonds, and strengthen the risk management of green bonds. Second "green" this characteristic means that the environmental benefit of the bond is more prominent, its economic benefit is far from reaching the yield of many commercial projects, so enterprises may face the plight of economic benefit is less than environmental benefits, which requires enterprises actively innovation green bond yield way, enhance its appeal to investors, crack low economic benefit this problem.

Second, improve the third-party certification of green bonds and strengthen the degree of information disclosure. Green bonds different from ordinary creditor's rights is an important aspect of the third party certification, the third party certification is a kind of effective green bonds management, it can promote green bonds transparent promote social supervision, help the issuer select really beneficial environment, attract more investors to enhance the economic benefits of green bonds, and cultivate the green consciousness of the public, and improve the public awareness of the environment and low carbon energy saving. This paper suggests that the Three Gorges Group should actively improve the third-party green certification, which can not only improve the approval speed of bond issuance in the future, but also enhance the reputation of the enterprise to attract more investors. Secondly, strengthening information disclosure can greatly reduce the investment risk of green bonds and improve investors' trust and investment willingness in green bonds. Therefore, this paper suggests that the Three Gorges Group should further strengthen the degree of information disclosure. As a green exchangeable bonds, related green information should be timely public, accurate disclosure, but the three gorges group green bonds did not give the corresponding score elements, and green according to the information, the green information only simple tender, this phenomenon is obviously unfavorable to the long-term development of high group in the future.

At present, the requirements for information disclosure of green bonds in China are increasingly strict, because most of the funds raised through green bonds are invested in green projects. Investors can reduce their own risks by tracking the use of green bonds and observing the trend of funds in real time. However, China's current green bonds are managed by different companies, and a relatively standardized standard has not been formed for similar green bonds, leading to the issuance of uncertified green bonds at the same time as those certified bonds. This prevents investors to quickly establish trust in the bond although the content, quality and quantity of the disclosure are relatively complete. Therefore, in order to facilitate investors to confirm and reduce investment risks, bond issuing companies should further improve information disclosure and authenticate green bonds, so as to reduce investment risks.

7.2 Recommendations to government departments

Enterprises mentioned above in the green bond financing information disclosure is not complete and the root cause of the third party certification problems is the department of the government green bonds related supporting infrastructure is not sound, for green bonds investors, the main reason is that green bonds as a new financing tool, the government's propaganda work for investors and encourage policy is not in place, so the green bonds insufficient liquidity in the market. So this paper makes the following suggestions.

We will further improve the green bond information disclosure system and strengthen the publicity of green investment concept. In the development of green bond market time is relatively short, so many about the top of the city design and green bond system mechanism is not very perfect, the top design defects hindered the further development of green bonds, so you want to make green bond information disclosure system, can optimize management from the following two angles: first must perfect the relevant laws and regulations, improve the green bond market supervision and management mechanism, improve the supervision and management mechanism can not only promote fair competition in the green bond market, and can enhance the transparency of the market, enhance the overall credit level of the bond market. Therefore, the relevant departments should develop a corresponding project information disclosure document, including the relevant data and indicators to be published in different projects, as well as the standards and measurement methods to match the corresponding enterprises for reference; secondly, the third party certification body should regularly track and monitor the investment status of the project and the project, so that investors can understand the flow of funds, reduce information asymmetry, improve the transparency of green bonds, and avoid the occurrence of "green washing" phenomenon, so as to improve the quality of green bonds.

Green bonds as an important financial tool to support green low carbon transformation, can play capital leverage and policy guidance function, support the national overall development strategy, not only can create benefits but also can protect the environment, so our country government departments should vigorously support the development of green bonds, encourage investors at home and abroad to actively participate in environmental green projects, cultivate their green investment philosophy. First, the government should innovate the form of green investment, increase the financing channels by increasing the types of green bonds, and provide investors with more optional investment products to promote the development of green financial market; second, the corresponding departments should develop and improve the requirements of ESG standards and mandatory information disclosure. The development of ESG has attracted the keen attention of most countries in the world, and China should also follow the trend of The Times and actively publicize the ESG investment concept.

7.3 Inspiration to other enterprises in the same industry

We will focus on green financial policies and promote green projects. In recent years, the state vigorously encourages the development of green economy to support the growth of environmentally friendly enterprises. Enterprise managers should pay close attention to the national policy trends for green finance, understand the relevant regulations and requirements of green bond issuance, and clarify the direction and goals of enterprise green finance. The issuance of green bonds provides a reliable financing path for unlisted green companies. When choosing financing channels, non-listed companies often can only choose debt and can not consider equity financing, which limits their source of funds. Green bonds raise funds by mortgaging the shares of other companies held by unlisted companies, providing a new financing channel for unlisted green companies, and can quickly complete the approval process at a relatively low cost, thus reducing the debt burden of the company. In this case, the success of the green exchange bond issue reflects an positive bond innovation designed to create a good image of green bond companies. At the same time, green bonds with their own characteristics —— flexibility, profitability, public welfare, can meet the needs of issuers, investors, the public and other parties. Therefore, for those unlisted green companies, they can reasonably evaluate their development level and find them to meet their needs.

Pay attention to risk regulation, timely and accurate disclosure of information. For enterprises, green debt usually has interest rate risk, liquidity risk and credit risk. Although green bonds are less risky than ordinary bonds, they can not be ignored. Because no matter which risk occurs, it may cause different degrees of impact or damage to issuers, investors and the market as a whole. Therefore, when the issuer conducts green bond financing, it should hire a professional third-party risk management agency to manage it, or set up a risk control department with green bonds within the company, and monitor the risks to prevent them. Before issuing relevant green exchangeable bonds, enterprises should timely and fully disclose the bond issuance information, announce the reasons for bond issuance to the society as soon as possible, and timely inform the market of the progress of green projects. If we can pay attention to risk control and timely disclose information, we can build up confidence for investors to a large extent, and then have a positive impact on the stock market.

7.4 Implications for investors

When investing in green bonds, we should pay attention to the balance of risk and return, and be alert to the potential risks. Although green bonds have good environmental protection and social responsibility, but investors still need to focus on risk return balance, to combine the specific situation of green bonds, including the issuance enterprise credit rating, bond term, interest rates, to conduct a comprehensive risk and return assessment, to make a wise investment decision. For exchangeable green bonds, investors should generally pay attention to the following two aspects: first, in the nature of debt, investors should focus on the credit and operation of the enterprise, and strive to avoid the difficulty of the company; second, in terms of specific income, both individual investors and institutional investors should have a full understanding of the relevant bond issuance process.

So, before entering the green finance industry, you must carefully read the announcements and the terms to make sure you have a full understanding of the bonds you invest in. In the initial stage of bond issuance, it is necessary to interpret and understand the relevant terms and corresponding terms in detail to fully obtain the intrinsic motivation of the issuer; after the bond issuance, investors should pay close attention to the production and operation management of the target company, especially the financial situation, and make accurate judgment on the company and industry according to the market conditions to reduce potential risks. Only by fully combining their own risk tolerance and mastering the operation process of bond issuance, can investors better protect their legitimate rights and interests, make reasonable and scientific decisions, and finally realize the expected returns.

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