Comparative Analysis on Credit Risks of New Energy Industry and Traditional Energy Industry Based on KMV Model

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Abstract

Chinese economy now is facing two major challenges, "Structural adjustment" and "Growth Deceleration", restraint of energy and resources was increasing serious, the new energy industry and traditional energy industry play key roles in the economic transformation and upgrading and long-term stability progress. Then both of them are confronted with financing difficulties and credit risk to different degrees. This paper was based on the KMV model, and chose 64 listing Corporations as samples from new energy and traditional energy industry, and analyzed the structure characteristics of credit risk of them comparatively. The research result showed that the credit risk level of the new energy industry was higher than that of the traditional energy industry. According to the distribution, the credit risk of new energy industry was more concentrated, while the traditional energy industry polarized seriously. Finally this paper proposed the financial and credit policy suggestions.

Key words: NEW ENERGY INDUSTRY, TRADITIONAL ENERGY INDUSTRY, KMV MODEL, CREDIT RISK

1. Introduction

The relationship between supply and demand of current energy has undergone profound changes, the constraints of energy resource being growing, environmental problems being protruding. In November 19, 2014 the State Council issued The action projects of energy development strategy (2014-2020) and made the adjustment of energy structure as an important strategic guiding ideology, the development of new energy industry and the traditional energy industrial upgrading to become a core task.

New energy industry is one of the seven strategic emerging industries determined by The 12th five-year national strategic emerging industry development plan to accelerate the cultivation and development, playing a key role in speeding up the transformation of economic development mode of our country and promoting the rapid economic development. As a strategic emerging industry, new energy industry has the dual attributes of technology and market, its development process has a high input, high growth, high risk characteristics, compared with the traditional industry, the debt financing efficiency being low (Jiang Lingwei,2013), especially in the overall environment of the current sharp increase of the risk of financial market of our country, the credit risk problem of new energy industry is particularly prominent. Compared with the new energy, traditional energy is the foundation of modern industrial production of our country, the traditional energy industry is the pillar industry of national economy of our country. However, the recent price of coal, oil and other energy commodities continue to weaken, market volatility increasing. The stable development of the traditional energy industry is facing new challenges, especially after the incident of bulk commodities large loan risk of the Qingdao

port, the credit risk of traditional energy industry becoming the focus of social attention.

This paper with reference to the methods and ideas of KMV credit risk measurement models, comparing and studying the credit risk of new energy and traditional energy industry of our country, analyzing the characteristics of credit risk structure of the both, and try to put forward suggestions on development of new energy and traditional energy industry from the financial support.

2. Related Work

The KMV model is a default prediction model that America company KMV developed based on option pricing model, forecasting the probability of default of the bank of the listed corporation. Foreign scholars carried out a lot of research on the model. Through the empirical research, Crodbie and Bohn compared the theory of distance to default with EDF default database to prove that the KMV model can evaluate the credit risk of company(Peter C. et al, 2002), and using the financial companies as the sample to prove that it can detect the change of credit risk effectively. M.Tudela and G.Young showed that the KMV model is better than Probit model to forecast the credit risk level of listed Corporation through the empirical study (M.Tudela.et al, 2003) .

After the introduction of the KMV model into domestic, combining with our economic environment, the domestic scholars conducted related researches on the effectiveness of model from the empirical point of view. Through the prediction and analysis of credit risk of 5 consecutive years of 4 representative listed Corporation, Xia Hongfang, Ma Junhai proved that the KMV model can be used for the prediction of risk of the listed Corporation in China, and put forward to measure the credit risk more accurately, we should further improve the formula of the option pricing, considering the value of the assets jumping and consider the effect of changes in interest rates on the real value of debt (Xia Hongfang.et al, 2008). Zhang Nengfu, Zhang Jia taking the 82 ST and non ST listed Corporations in China as the research objects, carried on the exploration on the default points that applied to the measurement of credit risk of China's listed Corporations, pointing out that KMV model in China's stock market with weak validity has good prediction effect (Zhang Nengfu.et al, 2010) . Zeng Shihong and other scholars think that there are differences in the distance to default of different industries. And based on the modified KMV model, they carried on empirical research on credit risk status of manufacturing industry, and has carried on the preliminary exploration on the credit risk of energy saving and environ-

mental protection and other emerging industry(Zeng Shihong.et al, 2013).

Through the research and demonstration of the above scholars, KMV model can predict the credit risk of listed Corporations effectively. The modified KMV model is still applicable in China's special economic environment, providing the basis for the text research.

3. KMV Model
3.1. The basic of the model theory

The KMV model presented by KMV company in 1990s, the KMV model estimating the probability of default of listed Corporation in a certain period based on stock price and financial data of financial statements of listed Corporation. The theoretical basis of the model is mainly the option pricing theory of Black and Scholes and the corporate debt pricing theory of Scholes and Merton.

1.The option pricing theory of Black- Scholes

Option being a kind of important financial tool, options can be divided into American option and European option. European option can only exercise at maturity, and the American option can exercise in any trading day of the period of validity of the options. Black and Scholes mainly focused on European option to research. The assumption of their theoretical study is that there is short sale constraints, and securities trading having no transaction cost; secondly, there being no risk-free rate of interest and the risk-free rate of interest being fixed during the effective period of option; in addition, they assumed that the securities didn't have dividend distribution, the fluctuation of stock price submitting to lognormal model and the volatility of the expected return and stock price being certain. Based on the above assumptions, they put forward the option pricing equation, the pricing model of call option and put option.

2.The debt pricing theory of Merton corporate

Merton developed the theory of option pricing model Black-Sholes in his academic papers in 1974 and applied the model to the company claims. He found that the put option and the debts of the company have similarity. If the stock price of the due date was higher than the exercise price, the option seller would benefit from the options. Similarly, considering from the angle of the bank, when issuing a maturity of one year loan to a company, the company can use the loan for a variety of investments and get profit from these investments. After a year, if the market value of the firm was lower than the amount of loan, the owner having the intention of breaching the contract. On the contrary, the market value of a company was more than the total amount of loan after a year,

the company owner being willing to return the principal and interest of the bank loan.

3.2. Calculation of KMV model

Based on the above theoretical framework, the credit relation of debt financing is interpreted as trading options of seller. When a bank or other lender issued the loan to borrowing enterprises, it is equivalent to issue a seller's option the enterprise. The exercise price of options is the amount of borrowing, assets subject being the enterprise assets. In the end of borrowing date, the value of the assets was lower than the amount of borrowing, enterprises would choose to exercise the option, namely the default; if it was bigger than the amount of borrowing, the enterprise would repay the loan and retain the residual value of its assets. The happening of breaching depends on the compare of assets value of enterprise with the amount of borrowing and the volatility of the value of the assets (Lu Wei.et al, 2003).

1.The asset value (VA) and the volatility of asset value (δA)

According to the option pricing model, the equity market value of enterprise of KMV model VE can be expressed as a function of VA, D, R, T, Delta A, the specific formula being (Bodie Z.et al, 2012):

$$V_E = V_A N(d_1) - De^{-rT} N(d_2) \quad (1)$$

$$d_1 = \frac{\ln \frac{V_A}{D} + (r + \frac{\delta_A^2}{2})T}{\delta_A \sqrt{T}}$$

$$d_2 = d_1 - \delta_A \sqrt{T}$$

$$\delta_E = \frac{V_A}{V_E} N(d_1) \delta_A \quad (2)$$

In which VA is the market value of enterprise assets, D being the book value of debt of enterprise, r being risk-free rate of return, T being the debt maturity, δA being volatility of asset value of the enterprise, δE being the volatility of the equity market value of enterprise, N(d) standard cumulative normal distribution function. VE, δE can be obtained from the stock market, VA, δA can be obtained by the simultaneous equation (1) (2).

2.The default point (DP)

In KMV model, assuming that the total debt of company includes short-term debt and long-term debt, if the assets value of the company is lower than a certain proportion of their current debt, the company will default. In the KMV model, we use the default point to represent a certain proportion of debt. According to a large number of historical data of KMV company, we obtain that the default of the enterprise is the enterprise liabilities plus half of the long-term debt, namely that when the assets value of the enterprise is lower than half of the enterprise liabilities, the enterprise will default. There is: default point (DP) = (STD) +0.5 × long-term liabilities (LTD).

3.The distance to default (DD)

The distance to default is one of the indexes to measure credit risk, specifically referring to the distance of the expected value of the value assets of the company to the default, represented by the standard deviation ratio of the market value of assets. The calculating formula of the distance to default as follows:

$$DD = \frac{V_A - DP}{V_A \times \delta_A}$$

4.The expected default rate EDF

The KMV company obtained the function relationship between the distance to default (DD) and the expected default rate EDF by the statistical analysis of events of default of 43400 companies since 1973. But because the development time of China's capital market is short, the database of credit risk of enterprise being not perfect. We can't get the function relations between distance to default and the expected default rate and can't be accurately calculate the expected default rate.

In the comparative analysis of this paper, being relative to the default rate, the distance to default can be better showing the structural characteristics of the sample of enterprises. In addition, it is limited by the database of historical default, so this paper using the distance to default to compare the credit risk of sample firms, the longer the distance to default, the smaller the possibility of default of enterprise, and vice versa.

4. THE MEASUREMENT OF CREDIT RISK

4.1. Sample selection

New energy industry includes solar energy, wind energy, nuclear energy, biomass energy, geothermal energy, ocean energy, hydrogen energy and new energy technology and equipment, energy saving technology and equipment, batteries and other industries. Because the degree of stock market standardization of our country is low, a large number of enterprises using new energy concept to make speculation, seriously affecting the selection of sample enterprises. For the scientific selection of sample enterprises, making enterprises can be as much as possible to represent the industry characteristics of sample enterprise it belongs to, in this paper, according to the selection criteria of the card in the new energy index, in the 800 index constituent stocks of CSI, taking the related business of the above new energy of 32 enterprises whose proportion of income or profits ac-

counted for more than 30% as sample. According to the selection criteria of the card in the energy index, traditional energy industries selected 32 enterprises as samples in the CSI 800 index. The relevant sample financial data was disclosed by the listed Corporation.

4.2. The calculation of parameter

1.The enterprise equity market value VE

The traditional KMV model obtained the parameter of value of stock right directly by the multiplying of the stock price and the stock quantity, but this being not applicable in china. The equity division generally exists in the listed Corporation of our country, which brings bigger impact to the equity valuation of listed Corporation. There being tradable and non-tradable shares in securities market of our country, so we can't simply use tradable shares to value the non-tradable shares. This paper uses the market prices of stock to calculate tradable shares, using the book net assets value to calculate the price of non-tradable shares, the calculating formula being:

The value of stock right = market price per share of stock × the market value of tradable shares + net assets per share × the number of non-tradable shares.

2.The volatility of the equity market value δE

This paper uses historical volatility to estimate the volatility of equity market value of listed CorporationδE. The KMV model is based on option pricing model, assuming that the price change is continuous, so we should use the log price change method to calculateδE. Firstly calculated the daily volatility of the stock price in a year $X_i = Ln(\frac{P_i}{P_{i-1}})$, Pi being the closing price of the I of trading day of listed Corporation, Pi-1 being the closing price of the i-1 trading day of listed Corporation; then calculated the standard deviation of daily return rate δi, and finally calculated the volatility of the equity market value $\delta E = \delta i \times \sqrt{n}$, n being the number of trading days in a year.

3.The risk-free yield r

This paper adopts one-year deposit interest rate announced by the people's Bank of China as the risk-free rate yield, r=0.032.

4.The debt maturity T

According to the majority of debt term of China's corporate, we set the debt maturity as T=1 year.

5.The book value of debt of corporate D

The book value of debt of corporate came from the disclosure financial data of the listed Corporate.

6.The default point DP

The default point using KMV model to preset the default point DP=STD+0.5×LTD, the value of cash liabilities and long-term liabilities were from the disclosure financial data of the listed Corporate.

4.3. Analysis of calculating results

1. T test

In order to verify whether the distance to default of sample enterprise of the new energy and traditional energy industry have significant difference, we took independent samples T test on the distance to default of the both. The confidence interval is 95%, the test results as shown in table 1. The results of T test Sig<0.05, it's obviously that there being significant difference between the distance to default of sample enterprise of the new energy and traditional energy industry. This shows that it is feasible to determine the structure characteristics of credit risk of listed Corporation of the new energy and traditional energy industries. The KMV model is able to distinguish the difference between the data of the two groups of sample, it having reasonable practicality in the economic environment of our country.

2.Comparison of overall situation

Figure 1 is the curve of the distance to default of sample enterprises of the new energy and traditional energy industry in ascending order. From the figure we can see that these two curves except intersected in starting position, the distribution curve of the distance to default of sample enterprises of traditional energy being above the curve of new energy industry. The overall the distance to default of sample enterprises of traditional energy is bigger than sample enterprises of the new energy. The bigger the distance to default, the smaller the credit risk, so the credit risk of the overall level of new energy industry is greater than the traditional energy industries, being in line with the development stage of present China's new energy industry.

3.The distribution of interval

From the distribution histogram of the distance to default of sample enterprises of the new energy and

Table 1. T test results of default distance

		Levene testing of variance equation		T test of mean equation		
		F	Sig.	t	df	Sig.(bilaterl)
he distance to default	Equal variances assumed	8.857	.004	-4.035	62	.000
	Assuming unequal variances			-4.035	40.902	.000

Figure 1. The line chart of default distance

Figure 2. Distribution histogram of default distance
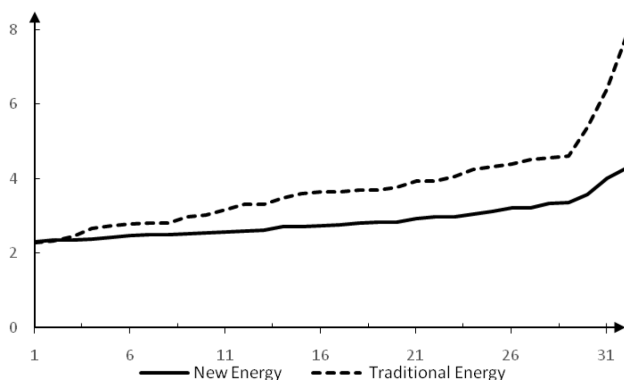
traditional energy industry we can see that the distribution of the distance to default of the new energy is more concentrated in the range of 2.5-3.5, the degree of concentration being higher; the distance distribution of traditional energy industry is average, the peak appearing in the 3.5-4.

4.Analysis of statistical data

Through the statistical data analysis table of default distance of sample enterprise of new energy and the traditional energy industries, getting the table 2

Table 2. Statistical data analysis table of default distance.

	Average value	maximal value	minimum value	median	standard deviation
new energy	2.87	4.28	2.31	2.74	0.47
traditional energy	3.76	7.77	2.28	3.63	1.16

5. Conclusion

This article selected a total of 64 sample enterprises of the new energy and traditional energy industry. Using the measurement model of KMV credit risk to evaluate its credit risk, through the comparative analysis of the sample data, and got the following conclusions:

1.The whole credit risk level of new energy industry is higher than that of the traditional energy industry, illustrating the comparison that, new energy industry having certain difficulties in debt financing, the risk being bigger.

2.The distribution of credit risk of new energy industry is concentrate, and with higher levels of risk, that the overall level of development of related enterprises of new energy industry being equal, still being at the primary stage. The main reason is that compared with the traditional energy, new energy has small shares, being lack of core technologies, research and development ability being insufficient, the blind competition and other serious problems; the risk level of the minority of new energy enterprises
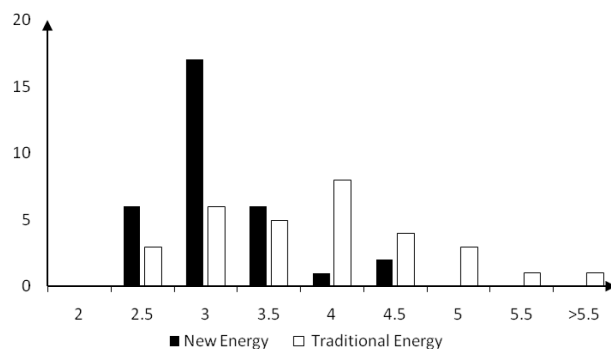
is relatively low, compared with the traditional energy industry, it being in the middle position. Such as CSG A, Dongfang electric corp., Rongxin shares etc. these enterprises master the key technology of the related fields, being the core of the industrial chain, and establishing close contact with the other traditional industries, fully embodying the guidance quality, relevance and other characteristics of strategic emerging industry.

3.The average risk level of traditional energy industry is low, but the industrial internal being uneven and having serious differentiation. Through the sample data we can see: credit risk level of large-scale energy enterprises such as China oil, China Shenhua is low, compared with it other small and medium enterprises it having higher risk. The main reason is the traditional energy industry is a kind of resource intensive industries, enterprise scale effect being very obvious. Especially recently coal, oil and other commodity market being in sustained downturn conditions, large enterprises showed a strong anti-risk ability, and anti-risk ability of small and medium-sized enterprise was weak, the subject to market fluctuation being obvious, the credit risk being generally higher.

6. Suggestion

6.1. The Traditional energy industries

One is that the traditional energy industry is to improve the level of intensive development, formulating the preferential fiscal and taxation policies, promoting the traditional energy industry level of technological progress, accelerating the pace of industrial upgrading, enhancing the competitiveness of the industry; two is to enhance the awareness of risk prevention, strengthening the market risks and the ability to control; Three is the innovation of financial tools, reducing financing risk and financing cost, enhancing the anti-risk ability of traditional energy industry.

6.2. The new energy industry

For the new energy industry, we should establish flexible and systemative financial support system,

fully playing the leading role of strategic emerging industry to the development of national economy, the details being as follows:

The national level(Zou Huixia, 2011). One is to promote the construction of a multi-level capital market, promoting the effective flow of assets; two is to encourage the establishment of investment fund of strategic emerging industry, to guide the flow of social capital, to support the long-term development of new energy industry; Three is to increase the fiscal expenditure of scientific and technological research and development, especially to enchance the financial support on the key technology research and development project of the industry, fanning out from point to area, to solve the financing difficulties that can't effectively financing of science and technology research and development project; Four is to provide preferential tax policies for the development of new energy industry.

The sector level. One is to strengthen industry management and reduce the risk caused by the vicious competition in the industry; two is to strengthen the industry development planning and avoid duplication of construction, to improve the use efficiency of resource. In addition to the banking industry, we should be based on the characteristics of new energy industry to formulate the effective method of credit evaluation and loan policy, establishing flexible mortgage guarantee mechanism, strengthening the loan support of development of new energy industry.

The corporate level. One is to rich financing channels and improve financing efficiency, reducing the reliance on debt financing; two is to pay attention to the introduction of strategic investment and risk investment, to obtain a stable source of funds to support the development of enterprises; three is to arrange the capital investment of equity capital and debt capital reasonably, improving the efficiency of the use of funds to maximize.

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