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Empirical Analysis of Risk Measurement of Science and Technology Companies based on GARCH-KMV Model

Taking anhui province as an example

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Abstract: In the report of the 19th National Congress of the Communist Party of China, General Secretary Xi Jinping pointed out that innovation is the first driving force for development. Technology companies play a vital role in the field of scientific and technological innovation. The long-term development of technology-based companies is inseparable from comprehensive and effective risk management. Since most companies do not have the characteristics of frequent transactions, the accurate measurement of volatility has always been the focus and difficulty of the company's risk management research. In order to explore the credit and risk management of technology-based listed companies in the same industry and industry, this paper selects 12 listed technology companies in Anhui Province, and uses empirical methods to estimate the accuracy of equity value volatility according to the GARCH-KMV hybrid model to improve KMV. The ability of the model to identify risks. In addition, based on the changes in the securities market, this paper establishes a dynamic volatility measurement model to propose more reasonable risk management recommendations for the securities market.

Keywords: GARCH-KMV model; Technology company; Credit risk; Risk management

1. Introduction

The role of technology-based companies in the field of scientific and technological innovation cannot be underestimated, the long-term development of technology-based companies is inseparable from comprehensive and effective risk management. As one of the representatives of Anhui's scientific and technological strength, Anhui science and technology enterprises, the effective measurement of credit risk is the basis of their innovative development. Credit is a key core of modern market economy and modern finance. The credit rating system based on risk prevention plays an important role in corporate management. Anhui science and technology enterprises are on the rise. However, there are few researches on the enterprise risk management of the scientific and technological listed companies in Anhui Province. This paper intends to provide the relevant company risk control research through the empirical analysis method from the perspective of Anhui provincial science and technology companies. New approach.

2. Literature and Theory Review

As one of the most mature credit risk measurement models in the world, the KMV model was founded in 1993 by KMV. The option pricing theory of Black and Scholes (1973) [1] and the corporate debt pricing theory of Merton (1974) [2] are the main theoretical basis of the KMV model. The GARCH model advocated by Poleslev T. Bollerslev (1986) can be used for regression analysis of financial data and modeling the variance of its error [3]. The KMV model modified with the GARCH model can measure risk more effectively. Early domestic and foreign scholars' research on KMV model and GARCH model is limited, and it is often used in the research and construction of theoretical basis and model framework, and lacks empirical research on theoretical practice. Due to the maturity of the capital market, the method of using the KMV model to predict the risk of the capital market has been widely favored by scholars. Liu Yingchun and Liu Wei (2012) proved that the KMV model is effective in assessing the financial risk of Chinese listed companies [4]. Yang Zhuqing (2018) shows that small and medium-sized listed companies not only need to research and develop innovation but also pay attention to the management of credit risk [5]. Most domestic and foreign scholars have studied the KMV model and the GARCH model from the macro level, but scholars have rarely studied the specific risk quantification problem. Studies have shown that the KMV model can quantify risk more effectively. However, most scholars ignore the characteristics of heteroscedasticity and the volatility

agglomeration effect associated with financial asset data, resulting in a decrease in the accuracy of volatility.

3. Empirical Analysis based on GARCH-KMV Model

3.1. Sample selection and data source

This paper selects the scientific and technological listed companies in Anhui Province as the main research object, and selects the most representative 12 stocks from the three major industries of new materials, new energy and electronic information. The data comes from the Eastern Fortune Software CHOICE database, which sets the sampling time from December 1, 2016 to December 1, 2018, for a total of 5,880 data.

3.2. Related variables and parameter settings

E is the company's equity value; t is the debt maturity; D is the market value of the company's liabilities; σA is the volatility of the company's asset value; VA is the market value of the company's assets; σE is the volatility of the company's equity value; rf is the risk-free rate The one-year fixed deposit rate is adopted; DD is the company default distance.

3.3. Parameter estimation and risk assessment

3.3.1. GARCH model parameter estimation and test

This paper selects the daily closing price data of the most representative 12 stocks from the three major industries of science and technology innovation in Anhui Province: new materials, new energy and electronic information. This paper uses Eviews9.0 software to carry out modeling statistics separately: the basic statistics and analysis of stock return rate, the GARCH (1,1) model is constructed by ARCH-LM test, the corresponding variance equation is obtained, and finally the equity value is obtained. Calculation of volatility. At this time, it is necessary to use the unconditional variance formula to convert the obtained 12 variance equations to obtain the respective annual volatility, where t is the actual trading days of the stock for 246 days per year.

Table 1. Variance equation

Industry	Securities name	Securities code	Variance equation
New material	Truchum	002171.SZ	σ_t^2 =0.0000219+0.059686 ε_{t-1}^2 +0.894144 σ_{t-1}^2
	Tong-feng	600237.SH	σ_t^2 =0.000154+0.046973 ε_{t-1}^2 +0.672841 σ_{t-1}^2
	Ty-magnet	002057.SZ	σ_t^2 =0.0000746+0.043872 ε_{t-1}^2 +0.832152 σ_{t-1}^2
	Meiling	000521.SZ	σ_t^2 =0.000110+0.124288 ε_{t-1}^2 +0.572754 σ_{t-1}^2
New energy	*ST Huaxin	002018.SZ	σ_t^2 =0.0000786+0.126231 ε_{t-1}^2 +0.739441 σ_{t-1}^2
	COFCO	000930.SZ	σ_t^2 =0.000193+0.171353 ε_{t-1}^2 +0.822646 σ_{t-1}^2
	Wenergy	000543.SZ	σ_t^2 =0.0000012-0.014324 ε_{t-1}^2 +1.012403 σ_{t-1}^2
	Jiangnan chemical	002226.SZ	σ_t^2 =0.000398+0.271074 ε_{t-1}^2 +0.692755 σ_{t-1}^2
Digital information	37 Interactive entertainment	002555.SZ	σ_t^2 =0.0000032-0.0166401 ε_{t-1}^2 +1.0151991 σ_{t-1}^2
	Guochuang software	300520.SZ	σ_t^2 =0.000309+0.081746 ε_{t-1}^2 +0.719545 σ_{t-1}^2
	IFLYTEK	002230.SZ	σ_t^2 =0.000105-0.004136 ε_{t-1}^2 +0.986045 σ_{t-1}^2
	JuLong	300475.SZ	σ_t^2 =0.000468+0.086417 ε_{t-1}^2 +0.860924 σ_{t-1}^2

3.3.2. KMV model parameter estimation

Different from the inherent calculation process of asset value volatility, this paper firstly combines the volatility of equity value obtained by GARCH model and solves the nonlinear equations through financial MTLAB software. Eventually, the asset value volatility and default distance are settled. (The time deposit rates for the 2017 and 2018 bienniums are risk-free, or 2.1%)

4. Empirical Analysis of GARCH-KMV Model Results and Risk Measurement

4.1. Empirical analysis

Using financial MATLAB to solve the nonlinear equations, the volatility of the company's asset value is obtained. Finally, based on the volatility of equity value and the volatility of the company's asset value, the default distance data is obtained and empirical analysis is made to obtain a reasonable risk management strategy. The actual calculation results are as follows.

Table 2. Empirical analysis results

Industry	Securities name	Securities code	Equity value (100 million yuan)	Volatility of equity value	Asset value (100 million yuan)	Asset value volatility	Default distance
New material	Truchum	002171.SZ	56.9888	0.3416	69.7941	0.3160	2.9175
	Tong-feng	600237.SH	19.9223	0.3677	25.7161	0.3094	2.6976
	Ty-magnet	002057.SZ	23.6635	0.3847	25.6725	0.3444	2.5861
	Meiling	000521.SZ	32.8828	0.2989	123.8183	0.2012	2.9774
New energy	*ST Huaxin	002018.SZ	28.0173	0.3794	36.0851	0.2464	2.5724
	COFCO	000930.SZ	75.7063	2.8128	111.0107	2.7851	0.3081
	Wenergy	000543.SZ	83.4325	0.3920	190.1143	0.2928	2.5132
	Jiangnan Chemical	002226.SZ	74.6891	1.6452	124.5941	1.5903	0.5893
Digital information	37 Interactive Entertainment	002555.SZ	254.1345	0.3794	274.8379	0.3639	2.6309
	Guochuang Software	300520.SZ	32.3638	2.8128	35.3537	2.7835	0.3027
	IFLYTEK	002230.SZ	515.1810	0.3920	543.0907	0.3630	2.5422
	JuLong	300475.SZ	17.3800	1.6452	19.0172	1.5406	0.5476

4.2. Empirical analysis of default distance

At this time, the volatility of the equity value calculated by the GARCH model can be modified to some extent to improve the accuracy of the model. E Views software was used to calculate the correlation between equity volatility and default distance in three industries. The correlation coefficients of new materials, new energy and electronic information industry were -0.937924, -0.947081, -0.942092, respectively. The Pearson correlation coefficient is a negative number less than -0.9, that is, there is a negative correlation between the equity volatility and the default distance and the correlation is significant. The smaller the volatility of the equity value, the greater the default distance, and the corporate credit risk may increase. Therefore, the equity volatility and default distance obtained by the model can be used as an important indicator of analysis, and the model is well constructed, and the result data has credibility and precision.

4.3. Empirical analysis of risk measurement

4.3.1. The lowest value of equity value in the new materials industry among technology-based industries

From the perspective of industry, the volatility of equity value of new materials industry is not much different among enterprises, and it is less than the volatility of equity value of new energy industry and electronic information industry. At the same time, the equity volatility of the electronic information industry is generally large. The continuous updating and rapid development of science and technology has made electronic products need continuous innovation and replacement, so the electronic information industry generally has a large volatility. The time required for the R&D and application phases of the new materials industry is relatively long, and the production process of new materials requires constant trial and analysis. The new materials have a longer service life and a slower development speed. At present, the development of the new energy industry is also adapting to social conditions and the environment. The development of new energy sources is different and the degree of difficulty and time consumption are different. Therefore, the equity volatility of the new energy industry also has significant differences among enterprises.

4.3.2. The default distance of new materials industry is generally larger among industries

From the perspective of credit analysis: the default distance refers to the estimation of the default phenomenon when the value of the asset of the enterprise fluctuates within a certain standard deviation within a certain period of time. From the statistical data of the table, the default distance of the new material industry is large and there is little difference between them; and the default distance of the new energy industry and the electronic information industry is roughly the same, and the default situation between the same industry is not small. Difference. Although Jiangnan Chemical in the new energy industry is a hot enterprise, the risk of a sharp increase in the asset-liability ratio of the company caused by the acquisition of "Dun an New Energy" in 2016 has a relatively high probability of default; COFCO is currently in mergers and acquisitions. In the case of a similar situation, after the listing of Keda Guochuang in the electronic information industry, the company's share price has experienced repeated fluctuations due to repeated reductions and pull-ups. At the end of the paper, combined with the results of the default distance obtained by the model and the actual company situation, it can be seen that the four stocks have a small default distance and a high probability of default.

4.3.3. The volatility of equity value of technology companies in various industries is greater than the volatility of asset value, and is positively correlated.

From a holistic perspective, the new materials, new energy, and electronic information industries all present a very similar situation: the volatility of equity value is positively correlated with the volatility of asset value. At the same time, the volatility of equity value of related companies is greater than the volatility of asset value. This is because the price of stocks is subject to macroeconomic policies, market economy, investor preferences, investor expectations of prices, operational risks, and emergencies. The influence of factors has been changing and the fluctuations are relatively large.

5. Conclusions and Recommendations

The GARCH-KMV model has a high recognition ability in corporate credit risk measurement, laying a theoretical foundation for solving the credit risk measurement problem of Anhui science and technology listed companies; laying a practical foundation for improving the credit measurement ability of Anhui science and technology listed companies. This paper selects the data of Anhui science and technology listed companies from 2016 to 2018 as a sample, and estimates the volatility and default distance through industry classification (new materials, new energy, electronic information), and empirical research on the dynamic panel-corrected KMV model. In the technology-based industries, the volatility of the equity value of the new materials industry is the smallest; the default distance of the new materials industry is generally large among various industries; the volatility of the equity value of the technology companies in various industries is greater than the volatility of the asset value, and is positively correlated. Conclusions, innovation and development of enterprises should be a long-term competitive strategy. Emerging technology-based enterprises have a relatively short development time and a relatively fast development rate. The possibility and volatility of their corporate defaults are roughly proportional to the development time and speed. Inspire relevant departments and enterprises to pay more attention to the risk management of emerging technology-based enterprises. In order to reduce corporate credit risk, bring greater benefits to enterprises, and better reduce corporate risks.

In order to effectively improve the risk prevention capability of science and technology listed companies and related investors in Anhui Province, this paper puts forward the following suggestions based on the final conclusion of the empirical analysis of GARCH-KMV model.

5.1. Improve the system of credit risk management

Improve the information review and information disclosure system of listed companies. At the same time that listed companies disclose their financial statements, the company needs to improve the credit risk management system and maintain a stable growth rate in line with the basic principles of accountability to shareholders. In 2013, "Yangeng Power" suffered significant losses due to misrepresentation of the capital increase and other irregularities. Therefore, improving the relevant credit risk management system is the key to controlling credit risk.

5.2. Enhance employees' awareness of credit risk management

The employees of the company are the developers and supervisors of the enterprise. The personnel of the company are required to operate according to law and openly act, and put forward scientific and reasonable suggestions for the risks existing in the construction of the company. In 2010, Chujiang New Materials Enterprise was finally departed and criticized by the Shenzhen Stock Exchange due to the violation of its chairman's shareholding in the company's stock. Eventually, corporate credit and word of mouth suffered serious losses. It reflects the importance of cultivating corporate employees or management credit risk awareness.

5.3. Strengthen market credit risk management

To strengthen the construction of China's capital market, relevant departments need to propose corresponding effective measures against the shortage of the GEM capital market, and reduce the occurrence of events such as manipulation of stocks and credit defaults. According to the correlation between the default distance of the enterprise and the frequency of default, a database of defaults that is conducive to the development of the Chinese characteristic road should be constructed. Based on this grim background, Anhui science and technology companies need to leverage the market price lever to improve the company's credit system and combine diversified risk management tools to enhance credit risk management.

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