Proceedings of the 2nd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/97/20230495

A Study of the Impact of Solvency Indexes on Stock Price Volatility in the Energy Industry

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Abstracts: In recent years, the energy industry has developed rapidly, opportunities and competition coexist in the industry, and energy stock price fluctuations are frequent. The article takes the listed enterprises in the energy industry in 2018-2023 as the research object, constructs the evaluation system of debt service indexes, and analyzes the relationship between debt service indexes and stock price volatility in the energy industry by using the fixed effect regression analysis method. The results found that: the gearing ratio and current ratio of energy enterprises are significantly positively correlated with their stock price volatility, and the nature of the enterprise is a new energy enterprise or a traditional energy enterprise, the correlation between their solvency index and stock price fluctuation also has a different strength. The stock price volatility of traditional energy enterprises is more affected by their solvency indexes, while that of new energy enterprises is comparatively less affected.

Keywords: Stock price volatility, solvency indexes, Conventional energy, New energy sources

1. Introduction

As an energy-consuming country, China to coal, oil, natural gas, and other conventional energy use, to achieve sustainable social and economic development. The development of new energy has become an important goal of energy development. The globe is becoming more and more interested in new energy, which is characterized by environmental preservation and renewable energy, and more idle funds are poured into the field of new energy and environmental protection, which has caused turbulence in China's energy stock market. Therefore, quantitative research on the volatility of China's energy industry stock prices not only contributes to the smooth development of the energy stock market, but also helps to guide investors to make correct investment decisions and avoid the risk of blind investment.

This paper takes the energy industry as the research object, combines its operating characteristics, and constructs the conduction model with stock price volatility from two dimensions: current ratio and gearing ratio. Based on the correlation and regression analysis of solvency indexes and stock price volatility, and through the group test to get more detailed research conclusions, and then targeted measures to improve the energy industry's operating performance and investor investment efficiency. In addition, this paper considers the relationship between solvency indexes and stock price volatility

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in traditional and new energy industries, which provides a theoretical basis and empirical data for regulators to formulate policies.

2. Literature Review and Research Hypotheses

2.1. Factors Affecting Stock Price Volatility

As a hot issue in the field of finance, stock price volatility has achieved more fruitful results in related research at home and abroad. Yun [1] et al, studied four airlines to analyze how three changes in crude oil prices affected their stock price volatility using VAR-GARCH-BEKK model. Chunpeng Yang, Huihui Wu [2] proposed a sentiment asset pricing model that argues that investor sentiment has a significant impact on asset pricing and affects stock price volatility. ThiKieuHoaPhan; NamHoaiTran [3] focused on the Vietnamese stock market to analyze how changes in dividend policy and ownership structure will affect its stock price volatility. Devers et al [4], discussed the implications for compensation design and research. Zhang [5] investigated the impact of high-frequency trading on stock price volatility and price discovery. AliF.Darrat; Shafiqur Rahman [6] studied whether futures trading activities cause stock price volatility. It can be seen that existing scholars' studies on stock price volatility mainly focus on the levels of external investors and internal managers. Compared with the previous literature, the possible marginal contribution of the article is reflected in the fact that it enriches the research on the factors affecting firms' stock price volatility. Unlike previous literature that mostly explores how to reduce share price volatility from the perspectives of institutional investors, media monitoring, and corporate transparency, this study enriches the relevant research results by verifying the impact of solvency indexes on share price volatility from the unique perspective of corporate solvency based on the data of firms in China's energy industry.

2.2. Enterprise Financial Assessment and Solvency

From the perspective of financial theory, the stock price of the energy industry is highly correlated with its financial status, Pang [7] focused on small and medium-sized companies to construct multiple variable indicator evaluation systems and studied the financial data of related enterprises. Zhang Yanping [8] analyzed corporate solvency and debt traps. Jeremy Kronick; Steve Ambler [9] illustrated that debt service is critical to finance. Firouzi [10] et al, proposed a new stochastic framework for optimizing the debt repayment plans with due consideration of the default probability of the project company. Ndubuisi [11] took Nigeria as a research object to investigate the impact of foreign debt on the country's economic growth. This can be seen as both an economic benefit of the operator's upfront decisions and a financial resource for the industry's future growth. Improved operating performance is conducive to a rapid rise in share price and the realization of the advantages of economies of scale. The study of the relationship between solvency indexes and stock price volatility is of great practical significance to energy industry operators, stock market investors and market monitors.

Scholars at home and abroad have conducted extensive research on solvency. In terms of evaluation methods and evaluation indexes, Yu Pengju [12] believes that the current ratio is too high, which shows that the short-term solvency of the enterprise is very strong, but at the same time, it also occupies too much of the enterprise's current assets, which indicates that the enterprise holds idle current assets that can not be profitably made so that its profitability is affected. The gearing ratio reflects the comprehensive ability of an enterprise to repay its debts; if the debt ratio is larger, the poorer the enterprise's ability to repay its debts; conversely, the stronger its ability to repay its debts. Huang Qianfu and Shen Hongbo [13] argued that short-term financial debt can bring financing difficulties and short-term debt liquidity pressure to enterprises, making refinancing risk increase. According to Xu Chenyang [14], debt heterogeneity can promote the improvement of firms'

DOI: 10.54254/2754-1169/97/20230495

innovation performance. Xiang Gu Yue [15] argues that when economic policy uncertainty rises, the risk of long-term debt increases, banks reduce long-term debt, and debt maturity tends to be short-term. Enterprises should pay close attention to economic policy uncertainty, financing strategy should be forward-looking; enterprises should expand diversified financing channels, endogenous financing, exogenous financing, indirect financing, equity financing, debt financing, and other methods should be multi-pronged; strengthen the regulation of information disclosure, to protect the interests of investors. Therefore, this paper proposes the following hypotheses:

H1: The gearing ratio and current ratio are positively related to stock price volatility in the energy sector.

2.3. Status of Development of the Energy Sector

Niu Junwang [16] that since the 21st century, China's oil, coal and other energy sources, such as the excessive exploitation and utilization of China's sustainable development, have brought greater pressure, China actively develop new energy sources and supported the development of new energy enterprises; Wang Wisdom [17] believes that the new energy industry is an important direction for future economic development, and in the future, China should increase the research and development of new energy, energy storage, renewable and clean energy technologies to create a sustainable green economic model; Li Hongxia and Chen Xiaonan [18] empirical research results show that the degree of financing constraints of new energy enterprises in China is significantly higher than that of traditional energy enterprises. Therefore, the new energy industry is developing steadily with the support of national policies and has become an important area of China's future economic drive. Therefore, this paper proposes the following hypotheses:

H2: Share price volatility in the new energy sector is less affected by debt service metrics than in the traditional energy sector.

3. Research Design

3.1. Sample Selection and Data Sources

This study uses energy businesses with A-share listings as its research sample, selects the panel data of energy companies in 2018-2023, and conducts empirical analysis according to the two categories of traditional energy and new energy industries, and the sample selection criteria refer to the China Securities Regulatory Commission 2012 industry classification standard and the SHENYIN & WANGUO Industry Classification Directory in 2021. The traditional energy industry mainly includes coal, oil, natural gas and other industries, and the new energy industry mainly includes wind power, photovoltaic, thermal power and lithium battery industries, etc. All data are from CSMAR database and WIND database. The sample data excludes insolvent companies, companies with missing financial data and ST and *ST listed companies. The sample data excludes the samples with insolvency, missing financial data, and the samples of ST and *ST listed companies. In addition, in order to effectively mitigate the possible bias of the findings caused by the extreme values of the samples, the Winsorize method was chosen to shrink the tails of all continuous variables at the 1% and 99% levels. After screening, the total number of valid samples is 3101, and the measurement software is Stata17.0.

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3.2. Variables Selection

3.2.1. Explained Variable: Stock Price Volatility

Among the existing studies on firm-level stock price volatility, measuring stock price volatility by calculating the standard deviation of stock returns is one of the more recognized metrics. Therefore, quarterly stock price volatility (denoted as VOL) of energy firms is measured by drawing on this methodology, which is calculated as follows:

$$x_t = log(\frac{p_t}{p_{t-1}}) \tag{1}$$

$$\bar{x} = \sum_{t=1}^{n} \frac{x_i}{n} \tag{2}$$

$$\sigma_x = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(x_i - \overline{x})^2} \tag{3}$$

Where p_t is the closing price of the stock on the trading day, x_t is the logarithmic return on the trading day, $\overline{x}$ is the average value of the logarithmic return on the trading day over a quarter, and σ is the stock price volatility over a quarter.

3.2.2. Explanatory Variables

This paper studies both short-term solvency and long-term solvency, adopting the two most representative indicators, current ratio and gearing ratio, denoted as CR and LEV, respectively. Among them, current ratio is a measure of a company's ability to convert current assets into cash to pay its liabilities before current liabilities mature. The gearing ratio, using assets as a reference, reflects the size of an enterprise's debt, which in turn reveals its long-term solvency.

3.2.3. Control Variables

There are many other factors affecting the volatility of listed companies. This paper combs and summarizes the relevant references, and chooses five indicators as the control variables of this paper: the net profit margin of total assets (ROAb), the growth rate of operating income (Growthb), the age of the company (age), the percentage of independent directors (Indepe), and the earnings per share (EPS), of which the age of the company plus one is taken as a logarithmic substitution for analysis and two percentages are substituted in decimal form for calculation. The definitions of the variables are shown in Table 1.

Table 1: Indicator Selection and Variable Interpretation

Variant	Name	Notation	Variable Interpretation
Explained variable	Stock price volatility	VOL	Sum the daily logarithmic returns over the quarter by squaring the difference between the logarithmic returns and the quarterly average of the logarithmic returns, divided by the total number of days minus one to make a root sign.
Explanatory variable	Current ratio Gearing ratio	CR LEV	Current assets/Current liabilities Total liabilities/Total assets

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Table 1: (continued).

control variable	Net profit margin on total assets	ROAb	Net profit/Average balance of total assets
	Revenue growth rate	Growthb	(Amount of operating income for the current year minus Amount of operating income for the same period of the previous year)/Amount of operating income for the same period of the previous year
	Company age	age	Difference between the accounting year and the year of establishment of the enterprise plus 1, in natural logarithms
	Proportion of independent directors	Indepe	Proportion of the number of independent directors to the total number of directors
	Earnings per share	EPS	Net profit for the period / Paid-in capital at the end of the period

3.3. Model Building

In order to study the empirical impact of corporate solvency indexes on volatility, this paper takes stock price volatility as the explanatory variable, current ratio and gearing ratio as the explanatory variables with one period lag, and constructs the following model based on controlling the other variables, based on the results of robust Hausman test, and using the estimation of fixed effect model controlling for the industry effect and year effect:

$$VOL_{i,t} = \alpha_0 + \alpha_1 CR_{i,t} + \alpha_2 LEV_{i,t} + \alpha_3 ROAb_{i,t} + \alpha_4 Growthb_{i,t} + \alpha_5 age_{i,t} + \alpha_6 Indepe_{i,t} + \alpha_7 EPS_{i,t} + Indnme + Year + \varepsilon_{i,t} \quad (4)$$

Where α_0 denotes the intercept term, α_1 denotes the coefficient of liquidity ratio on stock price volatility, α_2 denotes the coefficient of gearing ratio on stock price volatility, and $\varepsilon_{i,t}$ is the random error term.

4. Empirical Analysis

4.1. Empirical Testing

In order to verify the research hypotheses proposed in the previous section, this paper adopts the fixed effect model to test the relationship between the current ratio, gearing ratio and stock price volatility of two indicators and stock price volatility in the new energy industry and traditional energy industry by the full sample first, and then in groups, and the results are shown in Table 2.

Table 2: Regression results of current ratio, gearing ratio and stock price volatility

	Full sample	New energy	Conventional energy
	VOL	VOL	VOL
L.CR	0.001***	0.001**	0.002***
	(4.913)	(2.274)	(5.038)
L.LEV	0.009***	0.008***	0.011***
	(5.349)	(2.758)	(4.681)

DOI: 10.54254/2754-1169/97/20230495

Table 2: (continued).

ROAb	0.002	0.011	-0.025***
	(0.389)	(1.551)	(-2.931)
Growthb	0.001***	0.000	0.003***
	(3.376)	(0.421)	(5.104)
age	-0.003***	-0.004***	-0.002*
	(-3.767)	(-3.538)	(-1.697)
Indepe	0.004	0.010*	-0.004
	(1.099)	(1.836)	(-0.740)
EPS	0.000	-0.000	0.001
	(0.490)	(-0.054)	(1.615)
_cons	0.030***	0.035***	0.025***
	(9.319)	(8.260)	(5.046)
N	2849	1503	1346
R^2	0.3290	0.2437	0.2448
adj. R^2	0.3211	0.2304	0.2322
F	9.648	4.377	10.101

t statistics in parentheses
** p < 0.1, ** p < 0.05, *** p < 0.01*

4.2. Full Sample Analysis

The regression results based on the full sample data show that the regression coefficients of the current ratio and gearing ratio on stock price volatility are both significantly positive at the 1% level, and both have significant explanatory power for stock price volatility, and both are positively correlated.

First, the significant positive correlation between the gearing ratio and stock price volatility preliminarily verifies the previous hypothesis. As an important indicator reflecting the long-term risk level of enterprises, the gearing ratio has different risk tolerance ranges in different industries. As an industrial industry, the energy industry is highly capital-intensive, with a long development cycle, and large capital investment, and often operates by means of loans and advance receipts, so the gearing ratio is generally high, generally 40% to 60%.

When the gearing ratio of some enterprises rises within a reasonable range, it indicates that the enterprises' ability to utilize external funds becomes stronger, and the funds raised by the enterprises through borrowing play a role in their operations, which may increase the shareholders' profits as the profit margin of the capital gained exceeds the interest rate of the borrowed funds, bringing positive psychological expectations to the investors and ushering in a certain increase in the share price.

If the gearing ratio of some enterprises is too high, the financial risk of the enterprise rises. If the profit margin is not impressive, the interest on excess borrowed capital has to be compensated by the shareholders' share of profits, and the risk borne by investors becomes correspondingly high. Investors who are unwilling to take this risk will sell their shares, so the higher the gearing, the higher the risk and the greater the incentive for investors to sell their shares. At the same time, potential investors may refuse to buy the stock due to risk aversion. The double pressure of holders and watchers leads to a fall in the stock price. As a result, gearing, as a long-term risk indicator for energy companies, is closely watched by investors, and its rise can affect the volatility of stock prices to some extent.

Second, the current ratio is also positively correlated with stock price volatility. As an asset-heavy industry, the energy industry needs to maintain a high level of liquidity due to the slow pace of sales returns. When the current ratio rises within a reasonable range, it indicates that the short-term solvency of the enterprise is enhanced, which will increase investor confidence and bring about an

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increase in stock price. When the liquidity ratio of an enterprise exceeds the normal range, the enterprise may face the risk of inventory backlog or low capital utilization, investors may sell their shares out of caution, and potential investors will not buy, which will lead to a decline in share price. Therefore, as an indicator of a company's short-term capital position, a rise in the current ratio will also affect stock price volatility to a certain extent.

In summary, assumption 1 is valid.

4.3. Industry Comparative Analysis

From the group regression analysis of traditional energy industry and new energy industry, what can be observed is that the regression coefficients of current ratio and gearing ratio on stock price volatility of traditional energy industry are higher than that of the new energy industry, and the impact is also more significant. New energy is the main force of the global energy transition, and the development momentum is strong, China's new energy industry in the strong support of national policy for many years to maintain the world's first high-speed growth. In addition, in recent years, due to the new crown epidemic and the impact of the Russian-Ukrainian conflict, new energy as a long-term balance of energy security and low-carbon transformation of the optimal option, get the attention of countries around the world, the investment heat continues to rise. The new energy sector has maintained its position as a solid investor, and share price volatility has been weakened by the impact of corporate liquidity and gearing ratios.

In contrast, the traditional energy industry is more susceptible to the impact of the macroeconomic environment, its investor confidence is more insufficient than the new energy industry, and the changes in the enterprise's own debt-servicing indicators are more likely to cause changes in investor sentiment. Thus the increase in the gearing ratio and liquidity ratio is more likely to cause stock price volatility. Therefore, assumption 2 is valid.

5. Conclusion

Based on the perspective of corporate solvency, this paper analyzes the relationship between the solvency indicators and stock price volatility of China's A-share listed companies in the energy industry during the period of 2018-2023 by using panel data analysis. It obtains the following conclusions: on the one hand, there is a significant positive correlation between the current ratio, the gearing ratio, and the stock price volatility. When the energy industry is subdivided into traditional and new energy industries and analyzed, the strength of this positive correlation is significantly different. The effect of the gearing ratio on stock price volatility is strongest among listed companies in the traditional energy industry and slightly weaker in the new energy industry. In contrast, the effect of the current ratio on stock price volatility is relatively weak in both types of industries. This suggests that investors should pay attention not only to the long-term solvency indexes of companies but also to the changes in short-term solvency indexes to gain quick insights into the risks of investing in companies.

In addition, the research results of this paper provide important implications for the healthy and stable development of China's energy industry:

First, enterprises improve the structure of debt-servicing programs.

At the same time, it improves the enterprise’s solvency, but also can effectively play the potential value of the capital chain. From the point of view of the actual capital planning of small and medium-sized enterprises in China, most of the enterprise's liquidity is invested in specific business activities, and very little capital is used for external investment, which also limits the profit space of the enterprise. To create more benefits, enterprises should further rationalize the planning of debt servicing plan, scientific allocation of liquidity, in order to ensure that the operation of retained funds

DOI: 10.54254/2754-1169/97/20230495

on the basis of the use of a portion of the funds for investment, so as to improve the coordination of the enterprise capital chain and business activities, fully explore the potential profitability of the enterprise has funds, which not only ensures that the enterprise to complete the task of debt servicing in a short period of time but also able to generate more Economic benefits.

Secondly, enterprises attach importance to debt risk assessment.

The establishment of a risk early warning mechanism, short-term debt servicing risk is predicted in advance, clear risk warning standards; the establishment of a risk response mechanism, the degree of potential risk warning and may lead to the consequences of the corresponding plan; in the risk response to take into account the double consideration of efficiency and cost, combined with the actual situation of the enterprise, neither choking on the food nor in order to improve the economic efficiency and ignore the long-term development of the enterprise, can make the All departments in the enterprise are involved in the main body, to realize the risk control and risk treatment of forward-looking and scientific.

Thirdly, the State should strengthen stock market supervision.

Regulators should not only continue to make clear requirements for indicators of dangerous debts of listed companies in the energy industry through legislation and regulations but should also take targeted measures to guide listed companies to rational and effective fund-raising and to stabilize investor confidence in accordance with their different levels of debt, respectively.

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