Research on the Relationship Between R&D Investment in New Energy Vehicles and Enterprise Risk-Resilience: A Case Study of NIO Inc

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Abstract: Behind the High Valuations of New Energy Vehicles Lies a Series of Risks, and these Emerging Companies are Profoundly Changing the Global Automotive Industry Landscape. In China, a group of new energy vehicles, such as Shanghai NIO Limited, has risen rapidly. However, high valuations bring potential challenges. This article will analyze the R&D investment, beta coefficient, and current ratio of NIO Inc. to explore the impact of R&D investment on the company's risk resilience.

Keywords: New Energy Vehicles; R&D Investment; Beta Coefficient; Current Ratio; Risk Resilience

1. Introduction

The automobile industry is undergoing a comprehensive transformation, moving towards electrification, intelligence, and sharing. A number of new energy vehicle brands have emerged worldwide, fundamentally altering the landscape of the automotive industry. However, despite the soaring valuations in the new energy vehicle sector, it also faces potential complex risks.

New energy vehicle companies have made substantial investments in research and development. This paper explores the relationship between R&D investment in new energy vehicles and enterprise risk resilience, measured by beta coefficient and current ratio.

2. Statement of the Problem

In the new energy vehicle industry, NIO Inc. is worth noting. As a rapidly rising Chinese new energy vehicle company, NIO was established in 2014 and experienced rapid growth. On September 12, 2018, NIO successfully went public on the New York Stock Exchange, raising approximately 1 billion USD with the ticker symbol NIO.NYSE. Despite the global economic impact of the COVID-19 pandemic in 2020, NIO's business development accelerated, achieving significant breakthroughs. By the end of April 2020, NIO successfully secured billions of dollars in financing in China.

NIO's stock price surged from $2 at the beginning of 2020 to a peak of $66 in February 2021, marking a more than 30-fold increase and reaching a market capitalization of $76.4 billion, making it one of the top five companies globally. However, over the following two years, the stock price declined, fluctuating around $10 in 2022 and 2023.

This paper aims to explore the relationship between NIO Inc.'s R&D investment and its enterprise risk resilience.

3. Review of literature

The beta coefficient measures asset-market correlation and sensitivity, predicting systematic risk. In the short term, beta coefficients offer stable risk assessment for individual stocks and portfolios. However, their stability weakens over time, making long-term risk prediction challenging.When studying R&D investment and risk resilience in new energy vehicle firms, it is necessary to consider dynamic beta coefficients and financial data like current ratios.

Research indicates that R&D expenses positively impact market value, shaping expectations of future cash flows as an investment

in intangible assets. Larger companies are more influenced, but smaller ones can also profit. These findings are valuable for understanding risk resilience and R&D investment in the new energy vehicle industry.

4. Research Methodology
4.1 Data Source
This study exclusively utilizes secondary data. The data used to calculate beta coefficients and current ratios are sourced from the company's annual reports and market data from the Dow Jones Industrial Average.

4.2 Timeframe
The study spans from the first month after NIO's listing, October 1, 2018, to July 2023. The beta calculation period for each time point is 30 days.

4.3 Analytical Tools
Descriptive statistics, ratio analysis, and regression analysis are employed as statistical techniques for data analysis in this study.

5. Objectives of the Study
Analyzing the impact of R&D investment on financial robustness in new energy vehicle companies: Through a longitudinal comparison of NIO Inc.'s R&D investment and financial data over the past few years, this study explores the influence of R&D investment on the company's financial robustness. Financial indicators such as liquidity are used to assess the company's financial stability, and the effect of R&D investment on these indicators is examined.

Investigating the impact of R&D investment on market value and risk resilience in companies: By collecting NIO Inc.'s stock price and market value data, along with using the beta coefficient as a measure of stock volatility, this study analyzes the influence of R&D investment on the company's market value and stock price fluctuations. Furthermore, it explores whether R&D investment has a long-term and short-term impact on stock prices and whether it helps to reduce stock price volatility.

6. Analysis and Interpretation
6.1 The correlation between R&D investment and the beta coefficient
Since its listing in September 2019, NIO's stock price has had a Beta coefficient of 1.638. In the first half of 2019, NIO's stock price Beta coefficient increased to 1.772, and by the third quarter, it rose to -3.837, indicating a significant increase in risk.

$$\beta = \frac{Cov(R_i, R_m)}{Var(R_m)} \tag{1}$$

Table 1 Calculation of Beta Coefficient.

	covariance	market_variance	Beta
2023-07-28	3.954	2.664	1.484
2023-04-03	-0.648	0.474	-1.367
2022-09-01	0.226	2.326	0.097
2022-04-01	1.334	1.942	0.687
2021-09-21	0.876	0.629	1.391
2021-04-01	-0.445	0.571	-0.780
2020-09-21	2.119	1.521	1.394
2020-04-01	4.572	5.747	0.795
2019-09-20	-2.025	0.528	-3.837
2019-04-02	-0.526	0.491	-1.072
2018-10-1	1.867	1.625	1.148

Table 1 Presents selected beta coefficients at various time points.
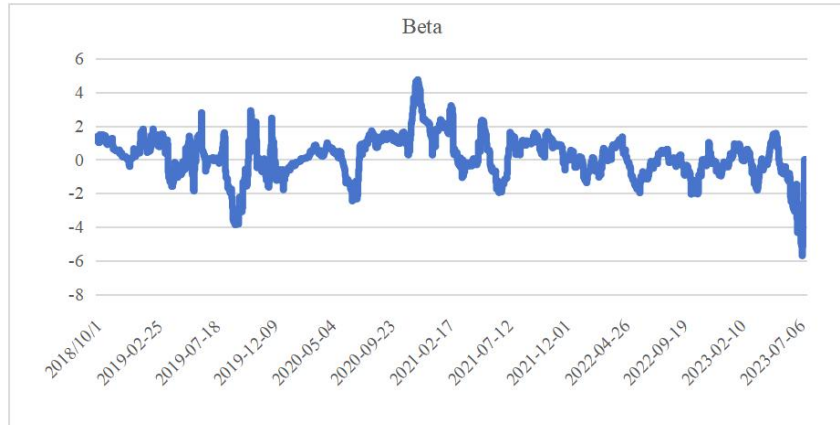

Figure 1 Beta coefficient of NIO Inc.

Figure 1 shows the beta coefficients from NIO's listing until July 2023.

Figure 2 NIO stock price

Figure 2 displays the stock prices of NIO from its listing until July 2023.

The formula for the correlation coefficient (Pearson correlation coefficient) is as follows:

$$r = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2 \sum_{i=1}^{n}(Y_i - \overline{Y})^2}}$$

(2)

- Xi and Yi are the individual data points for variables X and Y, respectively.
- $\overline{X}$ is the sample mean of variable X.
- $\overline{Y}$ is the sample mean of variable Y.

Table 2 R&D investment and risk resilience relationship.

	R&D Expenses (in million US dollars per year	Mean of Beta coefficient	Correlation Coefficient
2018	348.22	0.719063529	
2019	621.12	-0.088216236	
2020	232.58	0.643024352	-0.823
2021	644.02	0.616677196	
2022	1519.81	-0.316667119	

Table 2 shows a covariance of -0.823 between research and development (R&D) investment and the beta coefficient, indicating a negative correlation between them.

6.2 The correlation between R&D investment and the current ratio

The current ratio (also known as the liquidity ratio) is a metric used to measure a company's liquidity, assessing its ability to repay short-term debts. The formula for calculating the current ratio is as follows:

Current Ratio = Total Current Assets / Total Current Liabilities

In general, a current ratio higher than 1 indicates that the company has enough current assets to cover its short-term debts, which

is considered a favorable situation as it signifies a strong debt-paying ability.

Table 3 R&D investment and current ratio relationship.

	R&D Expenses (in million US dollars per year	Current Ratio	Correlation Coefficient
2018	249.43	5.13	-0.522
2019	348.22	1.42	
2020	621.12	0.52	
2021	232.58	3.31	
2022	644.02	2.18	

Table 3 reveals a correlation coefficient of -0.522 between research and development expenses and the current ratio, indicating a moderate negative correlation between them.

7. Conclusion

The covariance between research and development (R&D) investment and the beta coefficient is -0.823. In the financial and investment fields, the beta coefficient measures the correlation between asset returns and market returns, representing the asset's sensitivity to market volatility. A negative beta coefficient indicates an inverse relationship between the asset's returns and market returns, meaning the asset performs poorly when the market performs well, and vice versa.

In this case, there is an inverse relationship between R&D investment and market volatility (measured by the beta coefficient). This implies that when the market performs well, companies' R&D investments tend to suppress market volatility, reducing their risk exposure. On the other hand, during market downturns, companies may increase R&D investment to enhance their innovative capabilities and overcome adverse market conditions.

The correlation coefficient between R&D expenses and the current ratio is -0.522. The increase in R&D expenses requires substantial funds, which may reduce a company's liquid assets and, consequently, lower the current ratio. When companies undertake large-scale R&D projects, they need to invest significant funds, which could temporarily neglect the need for liquidity and lead to a decrease in the current ratio. R&D expenses represent long-term investments in a company's growth and innovation. While they may have some short-term impact on liquidity, in the long run, they contribute to enhancing a company's competitive advantage and resilience against risks.

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