

The Correlation Between Market Concentration and Market Profit Margin of New Energy Vehicles

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Abstract: The current new energy vehicle market is in an emerging period. The internal structure and order of the market are in a developmental stage, and there is significant competition within the industry. In the current era where major enterprises are engaged in price wars, it is important to control profits. For policy makers, observing market concentration can better control policy direction and assist enterprise development. This study collected and analyzed data from the top ten companies in the market value of the new energy vehicle industry. Including CR ratio, net profit margin, etc. This article analyzes the correlation between industry profitability and industry profitability from a quantitative perspective through Pearson correlation coefficient analysis. Result is found that there are strong correlation between the two index. The study provides a reference basis for the development of new energy vehicle enterprises and also provides judgment assistance for investors entering the market.

Keywords: New energy vehicles, Correlation Analysis, Net Profit Margin, Concentration Ratio

1. Introduction

The global production and sales of new energy vehicles have also maintained rapid development from 2019 to 2022. Within three years, global production increased from 2.356 million vehicles to 10.749 million vehicles. The development of new energy vehicles has also driven the development of related industrial chains. The global shipment volume of power batteries and chips has significantly increased. The global shipment volume of automotive power batteries in 2022 was 684.2GWh, a year-on-year increase of 84.42%. The number of chips increased from 33 billion in 2019 to 61.8 billion in 2022 [1]. Despite the impact of the epidemic during this period, the ability of enterprises to resume work has decreased and financing difficulties have arisen, but the global new energy industry chain has maintained a positive growth trend [2].

The new energy vehicle industry is in a rapid development stage. The market demand is constantly increasing [3]. The view that new energy vehicles will replace fuel vehicles has been widely recognized [4,5]. As a leading country in the development of the new energy vehicle industry, as of January 2024, China's market share of new energy vehicles has reached 29.9%, with production and sales increasing by 85.3% and 78.8% year-on-year, respectively [6].

Therefore, as an emerging industry, it is necessary to study the structure and competitive landscape of the new energy vehicle market. From the perspective of investors, it can help predict development

trends and form rational investment recommendations. From the perspective of policy makers, it can provide important references to help formulate policies that are more conducive to industry development.

At present, the relevant analysis of the new energy vehicle industry includes profit margin, Sharpe ratio, SWOT analysis, etc. These quantitative analyses can enable researchers to observe the market situation more intuitively. However, single data analysis has certain limitations. It lacks latitude and cannot capture the complex relationships between multiple variables. Establishing a composite data model can reduce errors from a comprehensive perspective and discover hidden trends that cannot be captured by a single dataset [7].

This research studied the industry concentration and profit margin of new energy vehicles and analyzed their correlation. The current new energy vehicle market can be evaluated from both market structure and economic benefits, providing more effective results and recommendations.

2. Model Formulation

2.1. Data Collection

When analysing the market concentration ratio, two index is used. The concentration ratio is the sum of market shares of the top companies in the industry. The index is an important influencing factor in determining the industry structure and profitability [8]. There is also Herfindahl-Hirschman Index (HHI). It is an indicator of market concentration. The higher the value, the higher the market concentration.

When analysing the industry profitability, the gross profit margin, the net profit margin and the operating margin are used. The gross profit margin refers to the ratio of the remaining sales revenue of a company after selling goods or providing services to the total sales revenue. It reflects the cost efficiency of enterprises in the production or service provision process. And the net profit margin refers to the ratio of a company's net profit to total sales. It considers all expenses except for production costs, including marketing expenses, management expenses, and interest expenses. Net profit margin is widely used in analysis of company profitability [9]. The operating profit margin refers to the ratio of profits obtained from a company's operating activities to total sales. It takes into account the profits generated by the daily business activities of the enterprise, does not include non-recurring income and expenses.

2.2. Variable Settings

The net profit margin was chosen as an indicator of industry profit margin because it is less affected by other factors. CR ratio has been selected as an indicator of industry concentration because it better reflects the situation of industry concentration. The data used in the research institute are all from major research institutions and recent official data released. Then perform data cleaning to remove abnormal data. Conduct correlation analysis using net profit margin and CR ratio as two variables to study their relationship.

In order to find the correlation of concentration and profit margin, 10 companies are selected. They occupy 60% of the market share in the new energy vehicle industry. Past 3 years' data were selected as the research objects. The average value was calculated by weighting the market share of each enterprise. Then the ratio will be recognized as the overall net profit margin of the industry.

2.3. Model Analysis

Many models can be used to judge the correlation. The first one is Pearson correlation coefficient. It is a statistical measure analysing the strength and direction of the linear relationship between two

variables. By calculating the Pearson correlation coefficient between industry concentration indicators (such as CR index, HHI, etc.) and industry profit margin indicators (such as gross profit margin, net profit margin, etc.), we can understand whether there is a linear correlation between them and the strength of the correlation. The other one is Spearman's rank correlation coefficient. It is a non-parametric statistical method used to measure the monotonic relationship between two variables. It does not require data to have a linear relationship but calculates correlation by converting the data into levels. By calculating the Spearman rank correlation coefficient between industry concentration indicators and industry profit margin indicators, the monotonic correlation between them can be understood. Also, Regression analysis can be used to explore and establish a relationship model between two or more variables. The industry concentration index can be used as the independent variable and the industry profit margin index as the dependent variable, and the relationship between them can be estimated through regression analysis. This can provide a deeper understanding of their correlation and predict the relationship between changes in industry profit margins and changes in industry concentration.

Those models are widely used in different analysis, helping finding the relationship between variables. Many research in financial, medical fields includes correlation analysis [10,11].

The hypothesis are as follow.

H1. There is a high correlation between industry concentration and industry profit margin.

H2. There is a high negative correlation between industry concentration and industry profit margin.

H3. There is almost no correlation between industry concentration and industry profit margin.

H4. The correlation between industry concentration and industry profit margin is relatively small.

3. Results Presentation

3.1. Overall Net Profit Margin

Table 1: Net profit margin of the top ten new energy vehicle market share companies in the past three years

Net Operating Profit Margin (%)	Year	2023	2022	2021
Company/Market Share (%)				
Tesla/21%		15.50	15.45	10.26
BYD/13.2%		5	3.9	1.4
BMW/3.7%		11.2	13.03	7.82
VWAGY/3.5%		4.97	5.32	5.93
SAIC/3.5%		2.56	3.07	3.15
GAC/3.5%		3.44	7.38	9.77
Benz/2.7%		9.48	9.82	7.03
LI/2.7%		9.53	-4.49	-1.19
Chang An/2.5%		6.28	6.39	3.43
Geely/2.4%		2.75	3.14	4.28

Table 1 shows the net profit margin of the top ten new energy vehicle market share companies from 2021 to 2023. The average net profit margin of these 10 car companies will be weighted based on market share to calculate the overall net profit margin of the new energy vehicle industry.

$$\text{Overall Net Profit Margin} = \sum_{i=1}^{10} (\text{Market Share} \times \text{Average Net Profit Margin})$$

The overall net profit margin after calculation is shown in table2.

Table 2: Estimated total profit margin of the new energy vehicle market in the past three years.

	2023	2022	2021
Overall Net Profit Margin(%)	5.45	5.17	3.63

3.2. CR Ratio

Table 3 shows CR10 ratios of the new energy from 2021 to 2023.

Table 3: CR10 ratio of the new energy vehicle market in past three years

	2023	2022	2021
CR10	59	55.5	52.5

3.3. Pearson Correlation Coefficient

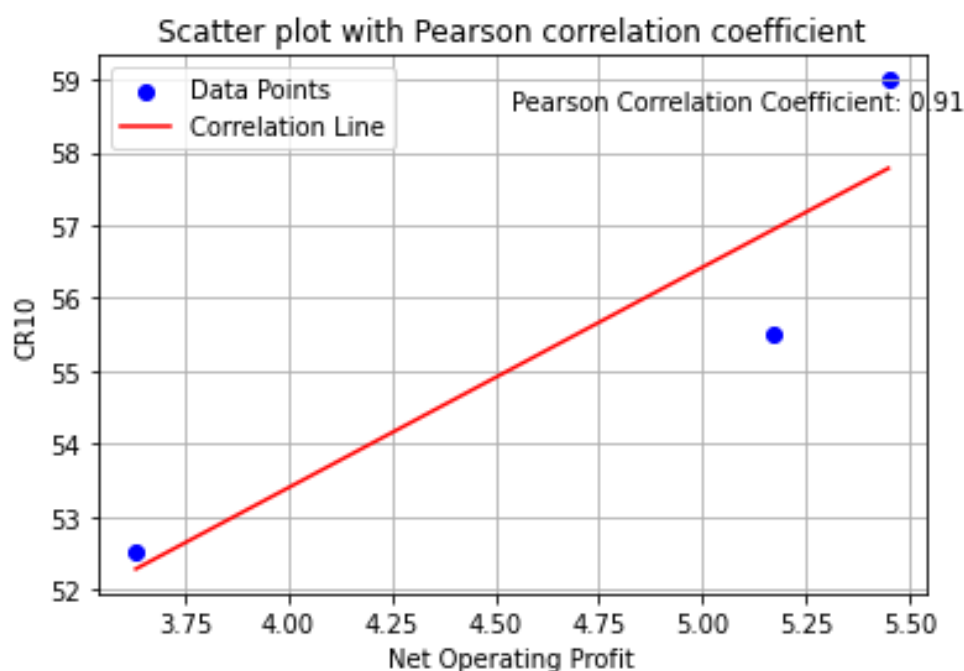


Figure 1: Pearson coefficient curve of CR ratio and net profit margin

Figure 1 shows that the Pearson correlation coefficient is 0.91, close to 1. The data fits the expected trend line well. This indicates that the model fits well. There is a strong and positive correlation between industry profit margin (reflected in net operating profit) and industry concentration (reflected in CR). According to the analysis results, H1 is consistent with the hypothesis. The other hypotheses are not supported.

4. Result Discussion

Figure 1 shows that the strong positive correlation (Pearson coefficient of 0.91) between industry profitability and concentration indicates that as industry concentration increases, profitability tends to rise. This suggests that investors may find higher returns in industries with greater market

concentration. While high industry concentration may present lucrative investment opportunities due to increased profitability, it also poses risks. Concentrated industries may be susceptible to oligopolistic behavior, market manipulation, or regulatory scrutiny, which could impact investment returns. Investors should tailor their investment strategies based on the level of industry concentration and associated risks. Industries with high concentration levels may offer stability and predictability in returns but may also face regulatory challenges or barriers to entry. Investors should also adopt a long-term investment horizon when investing in industries with high concentration levels. While short-term gains may be attractive, assessing the sustainability of profitability over the long term is crucial to mitigate risks associated with market fluctuations and regulatory changes. Also, Diversifying investment portfolios across industries and sectors can help mitigate risks associated with high concentration levels. By spreading investments across different industries, investors can reduce the impact of adverse events affecting a single industry and maintain portfolio stability. Conducting in-depth analysis of industries with high concentration levels is essential. Factors such as market dynamics, competitive landscape, regulatory environment, and technological advancements should be carefully evaluated to assess investment opportunities and risks accurately.

Furthermore, continuously monitoring industry dynamics, including changes in market structure, competitive positioning, and regulatory developments, is crucial for investors. Staying informed about industry trends and emerging opportunities allows investors to adjust their investment strategies accordingly. From the view of risk management, investors should strike a balance between risk and return when investing in industries with high concentration levels. While high profitability may be enticing, investors should carefully assess associated risks and consider factors such as market competition, regulatory environment, and industry trends.

For the suggestions, first of all, governments can enact regulatory policies to uphold market competition, prevent monopolistic behavior, and establish rules for fair competition. Then, governments can incentivize firms to engage in technological and product innovation to enhance industry competitiveness and innovation, thereby reducing industry concentration and promoting healthy market development. Also, governments can support the development of small and medium-sized enterprises (SMEs) to increase market competitiveness and reduce industry concentration. This may include providing financial support, technological assistance, and market access support. Moreover, governments can enhance market information transparency, strengthen market supervision and oversight, and prevent firms from exploiting information asymmetry to monopolize the market, thus safeguarding consumer interests. For investors, they should consider diversifying their investment portfolios across industries and sectors to mitigate risks associated with high industry concentration. By spreading investments across different industries, investors can reduce the impact of adverse events affecting a single industry.

Disadvantages of this article: The data volume is small. Due to the fact that the new energy vehicle market is an emerging market, there is little accumulated data. The dataset formed by the correlation analysis of the collected profit margin and concentration is relatively small. This will result in significant calculation errors and result calculations. The other one is estimation error. The method adopted in this study to calculate the industry profit margin is to select the top ten companies with market share and calculate the net profit margin weighted by market share. Replace the overall industry net profit margin with this average value. This calculation method has limitations when reflecting the market. There are also some model limitations. The model used in this study may have gaps in the relationships between variables.

5. Conclusion

The significant positive correlation (Pearson coefficient = 0.91) found between the profit margin and industry concentration in the new energy vehicle (NEV) sector holds profound implications for both

industry players and policymakers. This strong association underscores the pivotal role of market structure in shaping profitability dynamics within the NEV industry.

Firstly, the findings imply that as industry concentration increases, firms tend to enjoy higher profit margins. This suggests that firms operating in a more concentrated market environment benefit from enhanced pricing power and market share, thereby amplifying their profitability potential.

Consequently, businesses within the NEV sector should be attuned to shifts in industry concentration and strategically adapt to leverage these dynamics for sustained competitive advantage and profitability.

Moreover, the observed correlation underscores the importance of proactive regulatory oversight to maintain market competition and prevent monopolistic tendencies. Policymakers must carefully monitor industry concentration levels and implement measures to ensure a balanced competitive landscape that fosters innovation, efficiency, and consumer welfare. By fostering healthy competition and preventing anti-competitive practices, regulators can bolster market dynamics, ultimately benefiting both industry participants and consumers.

Looking ahead, the findings offer valuable insights into the future trajectory of the NEV sector. With rapid technological advancements and evolving consumer preferences driving continued growth and innovation in the industry, understanding the interplay between industry concentration and profitability will be crucial for stakeholders. As the market matures and consolidates, firms must navigate the evolving competitive landscape adeptly to sustain profitability amidst intensifying competition.

Furthermore, the findings highlight the need for ongoing research to delve deeper into the underlying mechanisms driving the observed correlation. Exploring factors such as market dynamics, firm strategies, and regulatory interventions can provide a more nuanced understanding of how industry concentration shapes profitability within the NEV sector.

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