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Enterprise Value Evaluation of New Energy Vehicle Enterprises from the Perspective of ESG: A Case Study of BYD

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Abstract:

In the context of global sustainable development, the new energy vehicle industry is booming, and enterprise value evaluation is also facing new perspectives and considerations. With the enhancement of environmental awareness and higher expectations of society for corporate responsibilities, the impact of ESG factors on enterprise value has become increasingly significant. As an important force in promoting green travel and sustainable transportation, the enterprise value of the new energy vehicle industry depends not only on traditional financial indicators but also on ESG performance. This study focuses on the value evaluation of new energy vehicle enterprises from the perspective of ESG (Environment, Society, Governance), and selects BYD as a typical case for in-depth study. The research finds that BYD has many highlights in its ESG practices and is closely related to enterprise value.

Keywords: ESG, New Energy Vehicles, Enterprise Value Evaluation, BYD

1. Introduction

With the increasing global attention to climate change and environmental issues, sustainable development has been emphasized, and the ESG concept has emerged and been widely applied. The development of new energy vehicles needs to consider ESG factors. Although China's new energy vehicle industry is developing rapidly, enterprises are facing challenges. The ESG concept brings new ideas for its value evaluation, which can reflect the enterprise value and sustainable development ability more comprehensively and objectively.

The thesis analyzes the enterprise value of BYD from the perspective of ESG, providing a reference for industry evaluation. In terms of the environment, BYD has been actively researching and producing new energy vehicles. As of July 11, 2024, the cumulative emission reduction amount is huge, and it has also increased the use of green energy. On the social level, it attaches great importance to product quality and safety, conducts battery recycling work, forms a closed loop of the industrial chain, and adheres to the "technology philanthropy" concept, actively participating in public welfare. In 2022, it donated 240 million yuan. In terms of governance, it has incorporated

ESG governance into the company's strategy, established relevant organizations and formulated systems. Analyzing BYD's ESG performance can comprehensively understands its enterprise value and contributes to industry evaluation and sustainable development.

2. Literature Review

The concept of ESG was proposed by Western developed countries, and foreign research on it started early with rich achievements, but scholars' views are not unanimous. On the one hand, most studies support a positive correlation between ESG and enterprise value. For example, Chelawat and Trivedi (2016) took listed companies in India as examples and empirically tested that good ESG performance can improve financial performance; Gunnar et al. (2015) reached a similar conclusion through a survey of scholars and investors; Ali Fatemi et al. (2018) found that good ESG performance can increase enterprise value, and practicing ESG can improve efficiency, increase cash flow and reduce financing costs; Wong et al. (2021) studied ESG certification of Malaysian enterprises and showed that it can reduce capital costs and increase enterprise value. On the other hand, some scholars believe that the relationship between ESG performance and enterprise performance is not significant. For example, Atan et al. (2018) reached this conclusion through an empirical study based on the data of listed companies in Malaysia.

Although domestic research on ESG started relatively late, it has shown a booming development trend in recent years. Yan Jie reached the important conclusion through empirical analysis that ESG evaluation has a significant positive impact on enterprise value. Moreover, this positive impact is more obvious in non-state-owned enterprises and enterprises with strong CEO power.

Zhai Xiao is committed to exploring the transmission mechanism of how ESG affects enterprise value. The research believes that the ESG performance of enterprises will affect their dividend payment ability and profitability, and then affect the expected future cash flow of enterprises; at the same time, ESG performance reduces the equity capital cost of enterprises by enhancing their ability to resist market systemic risks (there is a significant negative correlation between ESG performance and equity capital cost), and finally comprehensively affects enterprise value. He Zhijing took the impact of enterprise ESG performance on enterprise value as the main line and conducted in-depth research on the intermediary role played by financing constraints and enterprise efficiency in the positive value effect of ESG performance based on the intermediary effect model. The research shows that the ESG performance of enterprises can relieve financing constraints to a certain extent, and ESG performance can improve enterprise value by relieving financing constraints; at the same time, ESG performance can improve enterprise efficiency and then improve enterprise value.

3. Evaluation of BYD's Enterprise Value from the Perspective of ESG

3.1 Construction of the Evaluation Index System for BYD's Value from the Perspective of ESG

3.1.1 Construction of the Evaluation System Framework

The target layer of the value evaluation system for new energy vehicle enterprises is the enterprise value, which encompasses traditional financial value and the long-term sustainable development value brought by ESG. The criterion layer is divided into three dimensions: The environmental (E) dimension includes indicators such as energy consumption, waste disposal, and environmental protection investment, which respectively measure energy use efficiency, waste disposal effectiveness, and investment in environmental protection funds; The social (S) dimension has indicators such as employee rights and interests, consumer satisfaction, and community contributions, involving employee treatment and development, consumer evaluations, and relevant contributions to the community; The governance (G) dimension includes indicators such as board structure, information disclosure, and risk management, which examine the situation of the board of directors, information transparency, and risk response capabilities. See the ESG Index Evaluation System Table.

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Table 1 ESG Index Evaluation System Table

Target Layer	Criterion Layer	Indicator Layer
Overall ESG Performance	Environment (E)	Total amount and intensity of greenhouse gas emissions
		Energy utilization efficiency
		Proportion of renewable energy usage
		Amount of waste generated and treatment rate
		Proportion of investment in environmental protection R & D
	Society (S)	Employee satisfaction and turnover rate
		Length and coverage rate of employee training
		Complaint rate regarding product safety and quality
		Degree of participation in community public welfare activities
		Degree of fulfillment of social responsibilities in the supply chain
	Corporate Governance (G)	Independence and professionalism of the board of directors
		Reasonableness of executive compensation
		Transparency and timeliness of information disclosure
		Degree of perfection of anti-corruption and compliance systems

3.1.2 Comprehensive Consideration of Index Weights

(1)Analytic Hierarchy Process

Experts in the field of new energy vehicles, financial analysts, and enterprise managers are invited to form an expert panel. These experts possess rich industry experience and professional knowledge and are capable of conducting in-depth analysis and judgment on the relationship between ESG factors and enterprise value. Based on their own experience and professional knowledge, they conduct pairwise comparisons of factors at different levels. For example, in the environmental dimension, if an expert believes that the energy consumption indicator is more important than the waste disposal indicator, they may assign a higher score, such as 7 points, to the energy consumption indicator and a lower score, such as 5 points, to the waste disposal indicator. In this way, a judgment matrix can be constructed.

Suppose that in the environmental dimension, after the experts conduct pairwise comparisons of the three indicators: energy consumption (E1), waste disposal (E2), and environmental protection investment (E3), the constructed judgment matrix is:

$$\begin{matrix} 1 & \frac{7}{5} & \frac{3}{2} \\ \frac{5}{7} & 1 & \frac{5}{4} \\ \frac{2}{3} & \frac{4}{5} & 1 \end{matrix}$$

Calculate the maximum eigenvalue and the corresponding eigenvector of the judgment matrix. Through calculation, the eigenvector is obtained as $\left[\omega_{E_1}, \omega_{E2}, \omega_{E3}\right]$, Suppose that $\left[0.52, 0.28, 0.20\right]$. This eigenvector is the initial weight of the three indicators in the environmental dimension. To ensure the rationality of the experts' judgment, a consistency test is required.

(2)Calculate the consistency index

Adjust the enterprise value according to the ESG performance. $CI = \frac{\lambda_{MAX-n}}{n-1}$ Among them λ_{max} is the maximum eigenvalue of the judgment matrix, and n is the order of the matrix. RI And compare it with the average random consistency index (which is obtained by referring to the corresponding table). For a matrix of order 3, the calculation will be more complicated, $RI = 0.58$ Make a comparison. Calculate the consistency ratio $CR = \frac{CI}{RI}$. If CR£¼0.1 Then it is considered that the consistency of the judgment matrix is acceptable. Suppose that the calculated consistency ratio is less than 0.1, which indicates that the experts' judgments are reasonable to a certain extent.

(3) Determine the objective weights by using the entropy weight method

Collect the data of BYD on each ESG indicator. For example, collect data on energy consumption, waste disposal, etc. Then standardize these data to eliminate the influence of different dimensions. Commonly used standardization methods: $y_{ij} = \frac{x_{ij} - min(x_j)}{max(x_j) - min(x_j)}$ (Positive-ori-

ented Indicator) or $y_{ij} = \frac{max(x_j) - x_{ij}}{max(x_j) - min(x_j)}$ (Reverse indicator). Among them, i represents BYD, and j represents indicators. Assuming energy consumption is a positive indicator, BYD's energy consumption is x_{11}, and after standardization, y_{11} is obtained. Calculate the entropy value of each indicator as $e_j = -k\sum_{i=1}^{n} p_{ij} ln(p_{ij})$ based on the standardized data (where $k = \frac{1}{ln(n)}$, n are the number of enterprises, $p_{ij} = \frac{y_{ij}}{\sum_i^n y_{ij}}$).

For example, for energy consumption indicators, calculate their entropy value. The entropy value reflects the degree of information uncertainty of the indicator, and the smaller the entropy value, the greater the amount of information provided by the indicator. Calculate the entropy weight $\omega_1 = \frac{1-e_j}{\sum_{j=1}^{m} 1-e_j}$ based on the entropy value. After calculation, the standardized values of BYD's energy consumption are $\omega_1 = \frac{1-e_j}{\sum_{j=1}^{m} 1-e_j}$, and assuming $k = \frac{1}{ln(2)}$, the entropy value $e_1 = -k\left[p_{11} ln(p_{11}) + p_{12} ln(p_{12})\right]$ of the energy consumption indicator is obtained. Further calculate the entropy weight $\omega_1 = \frac{1-e_j}{\sum_{j=1}^{m} 1-e_j}$ (assuming there is only one indicator of energy consumption, i.e. $m = 1$) to obtain the entropy weight ω_1 of the energy consumption indicator.

(4) Determine the final impact weight by combining subjective and objective weights

By using linear combination, subjective and objective weights are assigned certain coefficients and added together to obtain the comprehensive weight. If the subjective weight coefficient is α and the objective weight coefficient is $1-\alpha$, then the comprehensive weight is $w_j = \alpha\omega_j + (1-\alpha\alpha)_{1j}$. For example, assuming that in the environmental dimension, the subjective weight of the energy consumption index is $\omega_{E1} = 0.52$, and the objective weight calculated by the entropy weight method is $\omega_1 = 0.45$. Let $\alpha = 0.6$ be, then the comprehensive weight of the energy consumption index is $\omega_{E1} = 0.6 \times 0.52 + (1-0.6) \times 0.4$.

By adjusting the value α, the proportion of subjective and objective factors can be flexibly determined according to the actual situation. If more emphasis is placed on the experience and judgment of experts, the α value can be appropriately increased; If we rely more on the objectivity of data, we can lower the value appropriately. The final weight of the impact of ESG factors on corporate value will be determined.

3.2 Value evaluation of BYD from an ESG perspective

Historical data calculation: Calculate the historical net operating profit after tax (NOPAT) using the formula NOPAT=(net profit+income tax+interest expenses) × (1- income tax rate)+R&D expenses × (1- income tax rate)+increase in asset impairment provision × (1- income tax rate) - non recurring gains and losses × (1- income tax rate)+increase in deferred income tax liabilities - increase in deferred income tax assets. Calculate the total historical capital (TC), where TC=debt capital+equity capital=short-term borrowings+long-term borrowings due within one year+long-term borrowings+bonds payable+long-term payables+total shareholder equity+provision for asset impairment+research and development expenses+deferred tax liabilities - deferred tax assets - construction in progress. For weighted average cost of capital (WACC), the cost of debt capital is the ratio of the interest expenditure of the year to the average total debt, and the cost of equity capital is determined according to the capital asset pricing model $Re = Rf + \beta \times (Rm - Rf)$, Rf is the yield of one-year treasury bond bonds from 2018 to 2022, β is from the CSMAR database, and $Rm - Rf$ is the average yield of the CSI 300 index from 2018 to 2022), and then WACC is obtained, from which the EVA value of 2018 to 2022 is calculated.

Future EVA forecast: Use the sales percentage method combined with average growth rate and compound growth rate to adjust the forecast financial statement items. Analyze the trend of operating revenue over the past five years, exclude the average growth rate of special year data, and refer to the report to set the growth rate for 2022-2023, with a stable growth rate after 2025. Predict the pre tax profit based on the historical average pre tax profit margin, take the historical average of the income tax rate, predict the R&D expenses based on the historical average ratio of operating income, and predict some accounting adjustment items based on the historical arithmetic average. Based on the assumptions of share capital, dividend policy, and capital structure, predict the amount of owner's equity and debt capital. Adjust the R&D expenses in the total capital adjustment item according to

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the above method, and take the historical average of other parts. Use the weighted average cost of capital from 2018 to 2022 as the average cost of capital to obtain the predicted EVA value for 2023-2025.

Enterprise value calculation: The sum of EVA present value during the high-speed growth stage from 2023 to 2025 is 34690502800 yuan, and the sum of EVA present value during the stable growth stage after 2025 is also 34690502800 yuan. According to the two-stage EVA valuation model, BYD's enterprise valuation V0 on the valuation benchmark date of December 31, 2022 is equal to the initial investment capital+EVA present value during the high-speed growth stage+EVA present value during the sustainable growth stage, which is 59779222.8 million yuan.

3.3 Compare the changes in enterprise value before and after adjustment

3.3.1 Indicator Weight

This article takes the indicator rating data of peer companies in the ESG rating database as a sample, calculates the indicator weights using the entropy method, and uses the expert rating method of distributing survey questionnaires to ESG experts, scholars, and relevant practitioners. The data is processed using SPSS software according to the steps of the Analytic Hierarchy Process to calculate the weights. Comparison shows that there is no significant difference in the weights calculated by the two methods, and the relative importance ranking of each indicator is basically the same, proving the reliability of the methods. Finally, by combining subjective (expert ratings and Analytic Hierarchy Process) and objective (entropy method) weighting results, the average weight of the two is taken as the final weight of the ESG factor indicator system. The specific table is as follows.

Table 2 Indicator Weights

Target layer	criterion layer	criterion layer	Indicator layer	Indicator layer weight
100%	environmental protection	61.35%	Product environmental performance	42.94%
100%	environmental protection	61.35%	carbon emission	43.12%
100%	environmental protection	61.35%	Supply chain environmental impact	13.94%
100%	social responsibility	30.55%	Product Quality and Safety	50.10%
100%	social responsibility	30.55%	Public Welfare and Charity	12.64%
100%	social responsibility	30.55%	Protection of Employee Rights and Interests	37.26%
100%	corporate governance	8.10%	Board of Directors	5.60%
100%	corporate governance	8.10%	Executive compensation	8.92%
100%	corporate governance	8.10%	risk management	14.74%
100.00%	corporate governance	8.10%	Business ethics	70.74%

3.3.2 Calculate the correction factor phase

Following the methods of previous literature, this article uses the industry average score level as a reference benchmark to adjust the scores of each indicator. The set score range for each indicator is 0-100 points, with 60 points as the baseline. If the score of a certain indicator is higher than 60 points, it means that the indicator is conducive to enhancing BYD's corporate value; If the score is below 60 points, it indicates that BYD's performance in this indicator will reduce the company's value.

After the above adjustment process, the scores of various evaluation indicators of BYD can be obtained. Multiplying the scores of each indicator by their corresponding weights in sequence and summing them up yields BYD's overall score. BYD's overall score is 72.62. Based on this score, the correction coefficient of ESG factors on BYD's corporate value can be calculated as 1.21 (calculated as $72.62 \div 60$). From the overall score, it can be determined that BYD's ESG performance has a positive impact on its own corporate value.

3.4 Result analysis

After incorporating ESG factors into the revised EVA model, BYD's comprehensive enterprise value as of December 31, 2022 was $1.21 \times 59779222.80 = 72332859900$ yuan. On that day, its stock closed at 256.97 yuan per share on the A-share market, with a share capital of 2911142855 shares and a total market value of

748076379400 yuan. The valuation comparison is as follows:

Table 3 Comparison of BYD's Enterprise Value Assessment: EVA Model Valuation Results, ESG-Adjusted Valuation Results, and Actual Market Value

project	EVA Model Valuation Results	Considering ESG factors to adjust the valuation results of the model	Real market value
Overall enterprise value (10000 yuan)	59779222.8	72332859.59	74807637.94
Value per share (yuan)	205.35	248.47	256.97
Valuation deviation rate	-20.09%	-3.31%	-

Compared with the valuation results of the EVA model, the comprehensive enterprise value of BYD increased by 16.79% after considering ESG factors correction, and the deviation rate from market value decreased to 3.31%. This indicates that the modified model considering ESG factors can make up for the shortcomings of traditional valuation models, more accurately evaluate the value of new energy vehicle enterprises, and also verify that good ESG performance helps to enhance enterprise value.

To verify the rationality of the revised valuation model, the correction coefficient was recalculated using data from other ESG rating agencies to evaluate BYD's value. But except for Runling Global, other institutions only publicly disclose the comprehensive rating at the standard level, without detailed indicator ratings. Solution: First, take the average score of three indicators at the standard level of each rating agency, and then recalculate the ESG contribution rate to BYD's corporate value based on weight. For grading on a scale of 10 or 10, first switch to a percentage system and then take the average.

After adjustment, BYD's E-level score is 72.55, S-level score is 82.25, G-level score is 70.53, and the total ESG score is 75.35. The contribution rate of ESG factors to BYD's corporate value is $\alpha = 1.26$. After adjusting for ESG factors, the enterprise value was 753218207300 yuan, an increase of 26.00% compared to the calculated value of the EVA model. The deviation rate decreased from -20.09% to 0.69%, which is consistent with the previous results, indicating that the valuation is more accurate after considering ESG factors.

4. Conclusion

With the increasing global awareness of sustainable development, the importance of ESG factors in enterprise value evaluation has become prominent. This study takes BYD as an example to explore the value evaluation of new energy vehicle enterprises from the perspective of ESG. The conclusion drawn is that firstly, ESG factors have a significant impact on enterprise value evaluation. By constructing an evaluation system that includes E, S, and G dimensions and determining indicator weights, the feasibility and scientificity of incorporating ESG factors into the evaluation have been confirmed. Comparing the changes in BYD's enterprise value before and after adjustment, it can be seen that ESG can make up for the shortcomings of traditional valuation models and make the evaluation more accurate; Secondly, BYD has shown positive performance and enhanced its value in ESG practices. Its environmental practices have reduced environmental burdens, improved competitiveness and brand image, while its social responsibilities have ensured operations, attracted talent, and increased recognition. Its governance structure and effective management have strengthened investor confidence and reputation.

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