Application of Big Data Analysis in Identifying Problems in Financial Reporting of BYD Company

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Abstract: With the advancement of technology, big data has been applied to various industries and fields. Its emergence has also sparked a revolution in accounting information processing and transmission technology. In the era of big data, the environment for corporate financial management is changing. For the new energy vehicle industry, the government's subsidy intensity for related enterprises has been continuously shrinking since 2017. In addition, the limited capabilities of enterprises themselves have brought enormous financial pressure to new energy vehicle enterprises. Therefore, for new energy vehicle enterprises, it is particularly important to avoid financial risks and enhance financial stability in this period. Therefore, this article takes BYD Company as a case study and uses big data analysis methods to identify the problems in cash flow, operational capacity, and debt repayment ability in financial reports, and proposes several improvement measures to adapt to the requirements of enterprise development in the new era of big data.

Keywords: Big data analysis; BYD; Financial reporting issues; Countermeasures

One of the prominent trends in recent years has been the emergence of "big data" in data analysis, which facilitates the utilization of large volumes of unstructured data and data streams as a valuable tool for identifying issues within a company's financial statements. Therefore, in this era characterized by big data, the methods employed for analyzing such vast amounts of information have a significant impact on the accounting knowledge possessed by financial personnel across various industries, as well as on the preparation of financial statements that traditionally focus on cash flow. Consequently, it is highly imperative to leverage big data analysis to identify existing problems within corporate financial reports and propose effective measures for enhancing their quality and standard. This paper will utilize BYD, a leading company in the new energy vehicle industry, as an example; employing big data analysis techniques, it will examine issues present within their enterprise financial report, discuss management strategies to address these concerns effectively, and ultimately improve the overall effectiveness and transparency of their reporting.

1. Comprehensive big data analysis

Big data analytics refers to the comprehensive analysis of vast amounts of data, emphasizing the extraction and preprocessing of annual reports obtained from the official website of enterprises. These reports encompass various financial indicators such as Total Current Assets, Total Current Liabilities, Total Liabilities, Total Assets, Quick Ratio, Operating Cost, Average Inventory, Increase in Total Assets for the Current Year, Total Assets at the Beginning of the Year, Net Profit, Average Shareholders' Equity, Total Profit, Operating Income and other key metrics. The meticulous sorting and repeated calculations involving 18 types of data including Average Total Assets and Average Accounts Receivable Balance among others resulted in tabular presentations. Subsequently, these processed findings were subjected to further analysis using entropy method and Dupont Analysis."

1.1 Advantages of big data analysis methods

Currently, the majority of accounting and financial reports in China fail to accurately reflect the true value-generating activities of enterprises due to issues such as information distortion, incomplete disclosure, and a lack of mutual correlation between provided information. Therefore, leveraging big data analysis can achieve two objectives:

(I) By objectively and comprehensively examining specific companies' annual financial statements, it becomes possible to identify and evaluate their financial risks. This analysis enables a clear understanding of the company's financial challenges while also facilitating the formulation of tailored preventive measures to address these identified risks. Consequently, this approach provides valuable insights for mitigat-

ing potential financial risks.

(II) In conjunction with an enterprise's existing financial risks, a mathematical model for evaluating these risks can be established through detailed situational analysis. By analyzing the root causes behind these risks, it becomes possible to exert control or even significantly reduce them—ultimately fostering sustainable development within the organization while offering relevant guidance for similar industries.

2. Big Data Analysis Financial Reporting Practice

The present study combines the entropy method, Dupont analysis, and other techniques to conduct a horizontal analysis of BYD's debt-paying ability, operating ability, and profitability using big data analysis.

2.1 Entropy Method Data Analysis

Based on the principle of entropy value method, this paper utilizes the efficiency coefficient approach and multi-objective programming principles to quantify each financial aspect of an enterprise into financial indicators, thereby determining a satisfactory value and an unacceptable value. By calculating the extent to which these indicators achieve a satisfactory value in a given year, assigning scores to each indicator, and subsequently conducting a comprehensive evaluation through weighted averaging, it will effectively encapsulate multiple operational characteristics of the enterprise into a comprehensive aggregate indicator that can be easily summarized and compared. This enables reflection upon the overall level of the enterprise's financial affairs and facilitates evaluation of its comprehensive financial condition for the studied year.

The risk coefficient of individual indicators, broad categories of indicators, and the overall risk coefficient of BYD Company are calculated based on its financial statements. The evaluation coefficients for each financial indicator of BYD Company from 2015 to 2021 are computed to determine both their individual and comprehensive performance.

2-1 Table of financial Risk Assessment coefficients of BYD for 2021

Classification of risk	index	Actual value(%)	Individual score value	Weight of indicators(%)	Coefficient of effect	COEFFICIENT OF INDIVIDUAL INDEX	INDEX EVALUATION COEFFICIENT	COEFFICIENT OF SYNTHESIS
Risk of financing	Asset-liability ratio	65	1.5	5	0.5	0.30	0.55	0.59
	Inventory turnover rate	4.34	5.21	6	0.34	0.87		
	Quick rate of action	65	2.12	5	0.25	0.42		
Risk of investment	Growth rate of total assets	47	9	9	0	1.00	0.63	
	Return on equity	5	3.74	7	0.68	0.53		
	Profit margin on sales	2	4.4	11	0.04	0.40		
Operational risk	Total asset turnover	0.73	4.42	8	0.65	0.55	0.60	
	Accounts receivable turnover	5.96	7.92	10	0.92	0.79		
	Turnover of current assets	1.30	5.52	12	0.3	0.46		
Cash flow risk	Cash recovery rate of assets	22	2.56	8	0.6	0.32	0.53	
	Cash to debt ratio	38	1.36	9	0.76	0.15		
	Surplus cash guarantee multiple	16.50	11	11	0	1.00		

The evaluation coefficient for both single and comprehensive indices from 2015 to 2022 will be calculated using the same method as presented in Table 2-1 above.

2-2 Table of evaluation coefficients for individual indicators of financial risk of BYD from 2015 to 2021

CLASSIFICATION OF RISK	INDEX	2021	2020	2019	2018	2017	2016
Risk of financing	Asset-liability ratio	0.30	0.24	0.24	0.22	0.28	0.36
	Inventory turnover rate	0.87	0.80	1.00	1.00	1.00	1.00
	Quick rate of action	0.42	0.44	0.48	0.48	0.50	0.49
Risk of investment	Growth rate of total assets	1.00	0.54	0.50	0.67	1.00	1.00
	Return on equity	0.53	0.61	0.50	0.54	0.59	0.76
	Profit margin on sales	0.40	0.53	0.40	0.47	0.60	0.64
Operational risk	Total asset turnover	0.55	0.59	0.50	0.53	0.51	0.59
	Accounts receivable turnover	0.79	0.36	0.18	0.17	0.15	0.25
	Turnover of current assets	0.46	0.48	0.43	0.44	0.43	0.51
Cash flow risk	Cash recovery rate of assets	0.32	0.33	0.24	0.20	0.08	0.01
	Cash to debt ratio	0.15	0.17	0.06	0.04	0.02	0.01
	Surplus cash guarantee multiple	1.00	1.00	1.00	0.95	0.67	0.30

2-3 Table of financial risk comprehensive assessment coefficients of BYD from 2015 to 2021

Classification of risk	2021	2020	2019	2018	2017	2016	2015
Risk of financing	0.55	0.51	0.60	0.59	0.62	0.64	0.55
Risk of investment	0.63	0.56	0.46	0.55	0.73	0.79	0.67
Operational risk	0.60	0.47	0.37	0.37	0.36	0.45	0.54
Risk of investment	0.53	0.54	0.48	0.45	0.29	0.12	0.27
Comprehensive evaluation coefficient	0.59	0.53	0.46	0.48	0.49	0.48	0.51

2-4 Financial risk profile of BYD from 2015 to 2021

CLASSIFICATION OF RISK	2021	2020	2019	2018	2017	2016	2015
Risk of financing	medium	medium	medium	medium	medium	medium	medium
Risk of investment	medium	medium	slightly higher	medium	slightly lower	slightly lower	medium
Operational risk	medium	slightly higher	slightly higher	slightly higher	slightly higher	slightly higher	medium
Risk of investment	medium	medium	slightly higher	slightly higher	high	high	high
Comprehensive evaluation coefficient	medium	medium	slightly higher	slightly higher	slightly higher	slightly higher	medium

The individual index score values and comprehensive evaluation score values of BYD Company from 2015 to 2021 have been compiled and presented. It is evident from the graph that the financial risk's comprehensive coefficient for BYD Company in 2019 stands at 0.46. Over the past five years, BYD has consistently maintained a medium to high level of financial risk, indicating an overall higher degree of financial risk for the company. Some financial indicators exhibit abnormal conditions, while profitability does not appear particularly promising.

BYD's fundraising performance from 2015 to 2021 was mediocre. According to the analysis, BYD has a substantial amount of short-term loans, significant financing activities, and limited repayment capacity. Furthermore, the escalating cost of raw materials over the past two years has led to a decline in inventory turnover and heightened financial risks. Combined with intense market competition, these factors contribute to an increased level of financing risk.

In terms of investment, BYD faced an extremely high level of risk in 2019 due to the declining state subsidies for new energy vehicles, which posed significant challenges to its development. This underscores the continued reliance of new energy vehicles on supportive policies for their survival. While in other years, BYD's investment risk may be at a medium or low level, it is still imperative that the company adjust its strategy promptly and strive to bring down this risk as quickly as possible.

In terms of operation, BYD Enterprise is still in a medium-high risk stage. However, it is evident that there has been significant improvement in operating capacity from 2017 to 2021. Nevertheless, certain risks persist, primarily manifested in the insufficiency of working capital and sluggish asset turnover. The low asset turnover can be attributed mainly to the company's substantial investment in new energy vehicles with a long payback period, coupled with inadequate management of accounts receivable and inventory.

In terms of cash flow, BYD was in a high-risk zone from 2015 to 2017, with a significant likelihood of facing a financial crisis. From 2018 to 2021, BYD's cash flow risk has been mitigated to a moderate-high level. However, the outlook remains cautious, necessitating continued efforts by BYD Enterprise.

2.2 Dupont analysis

This paper utilizes the fundamental concept of Dupont analysis to dissect a firm's return on equity into the product of three financial ratios, aiming to gain profound insights into the underlying sources of a firm's profitability. Dupont Analytics can effectively assist investors and management in comprehending a business's profitability and operational efficiency. By scrutinizing these three ratios, one can identify both the strengths and weaknesses of an enterprise in terms of profitability, thereby formulating appropriate strategies for improvement. Furthermore, Dupont analysis also facilitates industry comparisons for companies to ascertain their relative position and competitive advantage within the sector.

According to the Dupont analysis, BYD's net assets have been experiencing an upward trend. Based on the two charts provided below, there has been a rise in BYD's return on equity from 5.1% to 6.1% between 2017 and 2022. Through careful analysis, it becomes evident that this change is primarily attributed to a shift in operating margin. Furthermore, it can be observed that BYD's financial capacity has remained relatively stable with a slight increase in its operational capability, while its profitability has exhibited significant fluctuations.

	2018	2019	2020	2021	2022
Net interest rate (%)	0.03	0.02	0.04	0.02	0.02
Total asset turnover	0.70	0.65	0.79	0.87	0.97
Equity multiplier (Multiple)	2.66	2.66	2.46	2.51	2.87
ROA(%)	0.02	0.01	0.03	0.02	0.02
ROE(%)	0.05	0.03	0.08	0.04	0.06

2.3 Industry comparison

Using the horizontal comparison method, this study selects three representative enterprises in China's current automobile industry as samples and conducts a comparative analysis of their financial data at the same time point. The changing trend of the same index in different years is also compared to identify BYD's financial position changes and trends. By comparing sales, profits, balance sheet items, and other data of these three automobile enterprises while analyzing their solvency, operating ability, and profitability, we can directly compare BYD's operating conditions and development trends.

2.3.1 Enhanced solvency analysis

The level of corporate debt paying ability can reflect the level of corporate financing risk to a certain extent. Generally speaking, companies with strong debt paying ability can inject a shot in the heart for the steady operation of the capital market and promote more investors to provide funds for their operation and development. Fund-raising activities are fund-raising activities collected by enterprises in order to meet normal operation or expand production. The stronger the fund-raising ability is, the lower the fund-raising risk is. The following are the relevant data collected from BYD, Geely and Changan cars in recent years:

2-5 Relevant data of BYD from 2018 to the first half of 2023

YEARS	NET CASH FLOW	ASSET-LIABILITY RATIO	CURRENT INCOME RATIO	QUICK RATE OF ACTION
2018	391651.10	68.81	0.99	0.76
2019	661034.5	68.00	0.99	0.75
2020	-2890741.80	67.94	1.05	0.75
2021	1606251.70	64.76	0.97	0.72
2022	-1948868.30	75.42	0.72	0.48
First half of 2023	405021.20	77.94	0.66	0.44

2-6 Geely 2018 - the first half of 2023 related data

years	NET CASH FLOW	ASSET-LIABILITY RATIO	CURRENT INCOME RATIO	QUICK RATE OF ACTION
2018	-3060000	50.93	0.97	0.88
2019	176300	49.11	1.03	0.93
2020	446900	42.05	1.22	1.13
2021	112000	47.73	1.08	0.99
2022	5,213,128,000	48.35	1.15	0.99
First half of 2023	-4,756,599,000	44.23	1.03	0.87

2-7 Relevant data of Chang 'an from 2018 to the first half of 2023

YEARS	NET CASH FLOW	ASSET-LIABILITY RATIO	CURRENT INCOME RATIO	QUICK RATE OF ACTION
2018	135268.8	50.63	1.01	0.89
2019	40057.43	54.99	1.08	0.94
2020	704739	55.77	1.17	1.07
2021	259595.9	58.74	1.2	1.11
2022	22443.03	56.9	1.28	1.2
First half of 2023	-56615.8	58.9	1.27	1.16

According to the aforementioned three tables, it can be inferred that the asset-liability ratio serves as an indicator of a company's long-term solvency, with a lower ratio being more favorable. However, BYD has consistently exhibited a higher asset-liability ratio compared to Geely and Changan in recent years, indicating inadequate long-term solvency and a certain level of risk associated with debt repayment. It is recommended that BYD Company optimize its industrial structure and appropriately reduce its overly aggressive leverage strategy in order to mitigate financial risks.

The current ratio and quick ratio serve as indicators of short-term solvency for enterprises. A current ratio above 1 signifies that the enterprise's current assets are sufficient to cover its current liabilities, reducing the risk of defaulting on debts. Conversely, if the company struggles to meet its obligations with available assets, it may resort to borrowing new funds to repay old debts, thereby increasing its debt repayment risk and potentially facing financial difficulties. The quick ratio is a crucial metric used by industries to assess a company's ability to pay off short-term debts promptly. Generally speaking, higher levels of quick assets indicate stronger short-term debt paying capabilities. In terms of the ideal safe value for the current ratio compared to the quick ratio, industry standards suggest a 2/1 threshold. However, in the automobile industry specifically, an average level of 1.1/0.85 is observed among peers.

Upon analysis, it becomes evident that both Geely and Changan Enterprises maintain their liquidity ratios at normal levels while also exhibiting higher than average quick ratios—indicating their capacity for debt repayment but possibly suggesting inefficient utilization of monetary assets within these companies' operations.

In contrast, BYD Company demonstrates a lower than normal quick ratio which implies weaker debt repayment abilities and thus exposes them to certain financing risks. Consequently, effective measures should be taken by BYD Company in order to control their financing risks within acceptable parameters.

2.3.2 Operational capacity comparison

The primary performance indicator for assessing operational capacity is the asset turnover rate. The relevant data are illustrated in the figure below:

2-8 Accounts receivable turnover data of BYD, Geely and Chang 'an Enterprises from 2018 to the first half of 2023

| YEARS	BYD	GEELY	CHANG'AN
2018	2.57	11.7	41.22
2019	2.74	7.2	62.81
2020	3.67	3.5	56.76
2021	5.58	3.5	55.1
2022	11.3	4.3	55.12
First half of 2023	5.92	1.26	23.62
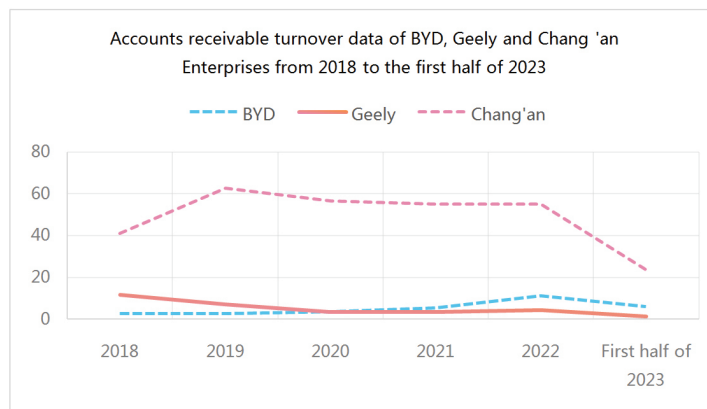
The accounts receivable turnover rate of Chang'an Enterprises is at a high level; however, there has been a downward trend since 2019. Nevertheless, overall, the operational capacity of Chang'an Enterprises remains commendable despite relatively slow turnover. Conversely, Geely and BYD exhibit deficiencies in this aspect as their accounts receivable turnover rates are comparatively low. This indicates insufficient comprehensive, efficient, and stringent management of accounts receivable along with untimely and inadequate collection practices leading to challenges in recovering funds promptly and facing elevated bad debt risks. It is recommended that BYD consider implementing certain measures to mitigate operational risks.

2.3.3 Profitability comparison

Profitability serves as a fundamental criterion for assessing a company's overall strength and effectively reflects its resilience against financial risks. When analyzing the profitability of different enterprises, investors and other users of relevant statements often opt for the return on equity index due to its objective and accurate reflection of investors' ability to achieve expected returns. This paper compares the return on equity of Geely, Changan Automobile, and BYD from a profitability perspective. Please refer to the figure below for further details.

2-9 Return on equity data of BYD, Geely and Changan Enterprises from 2018 to the first half of 2023

years	BYD	Geely	CHANG'AN
2018	5.04	5.7	1.47
2019	2.84	7.3	-6.01
2020	7.44	9.6	6.22
2021	3.2	16.2	6.37
2022	16.14	7.32	13.06
First half of 2023	9.36	2.07	11.7

Return on equity data of BYD, Geely and Changan Enterprises from 2018 to the first half of 2023

- - - BYD   —— Geely   - - - Chang'an
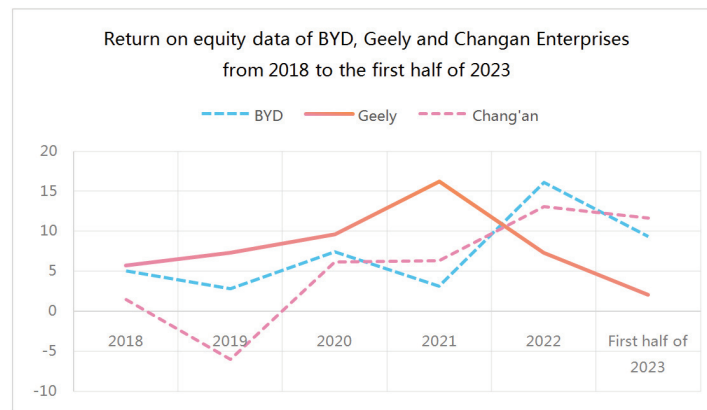
According to the aforementioned figure, it is evident that Geely has experienced a consistent upward trajectory in its return on equity, thereby ensuring its own profitability. Conversely, BYD and Chang'an have exhibited fluctuating earnings. Specifically, from 2020 to 2022, BYD's return on net assets displayed a downward trend due to the reduction of state policy subsidies and the continuous escalation of raw material prices over the past two years. However, there was a partial recovery after the first half of 2022 attributed to BYD's proactive expansion into international markets. Nevertheless, overall, BYD still maintains a relatively low return on equity and inadequate profitability.

After analyzing all the aforementioned data, we can derive the following inquiries regarding BYD Enterprise's financial position.

(1) Cash flow: Since 2019, BYD's net cash flow has generally exhibited a consistent upward trend; however, there have been negative net cash flows in both 2020 and 2022, indicating some instability in its overall cash flow. Considering the comprehensive analysis of the asset-liability ratio and enterprise development strategy, it can be observed that BYD has undergone a phase of rapid expansion over the past five years, which signifies a positive direction for the company's growth.

(2) Operating capacity: BYD's accounts receivable turnover has exhibited a certain upward trend in recent years; however, it remains comparatively low compared to industry peers. This can be attributed to internal management issues that hinder efficient collection of accounts receivable or an excessively lenient external credit policy, resulting in excessive capital tied up in internal accounts receivable and impeding both the enterprise's capital utilization rate and normal fund turnover. Overall, BYD's operating capacity is subpar, necessitating comprehensive measures for improvement.

(3) Solvency: In terms of long-term solvency, BYD's asset-liability ratio is significantly higher than that of other enterprises in the same industry, indicating relative backwardness and deficiency in BYD's long-term solvency compared to the industry average. Regarding short-term solvency, BYD exhibits a lower liquidity ratio compared to the industry average and a significantly lower quick ratio as well. Overall, BYD's solvency outlook is not optimistic; it faces relatively high financial risk and requires further improvement.

3. Measures to improve BYD's finance based on big data

3.1 Optimize the layout and strengthen cash flow management

Due to the nature of the industry, new energy vehicle enterprises still face excessive cash flow pressure during the process of asset transformation. The presence of excessively high book value of accounts receivable has emerged as a significant financial challenge for these enterprises.

3.2 Optimize operational costs and expenditures in order to enhance net profitability.

Enterprises should utilize big data to conduct scientific and comprehensive evaluations of the feasibility of marketing strategies, as well as optimize the utilization of operational costs and expenses. Big data analysis has always played a crucial role in precision marketing promotions, enabling enterprises to move away from high-cost mass marketing strategies and create opportunities for targeted marketing activities.

Firstly, marketing strategies should embrace diversity. Enterprises ought to leverage big data to discern customers' behaviors and intentions, employing specialized data analysis methods to select targeted marketing approaches. For instance, personalized recommendations can be provided based on customers' regular activities, thereby optimizing the effectiveness of marketing tactics.

Secondly, it is imperative to continuously enhance the internal financial management cost control of the enterprise, bolster the supervision and management of strategies, accurately, scientifically, and promptly analyze investment gains or losses post-implementation using big data analytics, and provide data-driven solutions accordingly. This big data analytics solution enables reduction in unnecessary waste while ensuring advertising relevance and cost-effectiveness.

The implementation of marketing strategy should include the establishment of a marketing strategy management data center and the utilization of sales data analysis. This will enable strict control over potential or possible issues in the marketing process, allowing for timely and effective countermeasures to be taken in order to reduce costs and improve net profit.

The allocation of marketing funds should be conducted in a scientific and rational manner to mitigate potential capital losses resulting from imprudent strategies, thereby optimizing operational costs and expenses while enhancing return on equity.

3.3 Rationally arrange the debt structure of enterprises and strengthen the risk management of financing activities

The application of innovative thinking is essential for expanding financing channels, enhancing the integration of external data resources, and utilizing real-time big data technology to monitor their financial status. This enables enterprises to select appropriate financing channels, mitigate excessive risk concentration, and improve their risk control capabilities.

Furthermore, enterprises should establish industrial digital management platforms themselves and leverage big data and artificial intelligence algorithms to establish effective communication channels with relevant financial institutions. Through data analysis operations, they can gain insights into the financial status and actual needs of enterprises in order to facilitate suitable matches with financing institutions.

Finally, it is advisable to reasonably increase the proportion of long-term debt in corporate liabilities and fully consider the debt structure to achieve a balance between long-term and short-term borrowing. Based on market trends and business scale, financing should be done reasonably to ensure that the ratio of debt funds and own funds remains reasonable. Rational allocation of debts for enterprises in different periods can reduce repayment burden and avoid negative impact on business credit.

The enterprises should continuously augment their own capital through rational operational methods, thereby bolstering the repayment capacity and mitigating debt repayment risks. This will ultimately enhance the competitiveness of the enterprises, facilitating their overall development.

4. Conclusion

Based on the data of the financial statements of BYD Co., Ltd. in the past five years, this paper first introduces the concept and advantages of big data analysis, then analyzes its single index score value and comprehensive evaluation score value with entropy method, analyzes its cash flow, operating capacity and debt paying ability with DuPont analysis method, and analyzes its possible problems. Based on the background of big data and the characteristics of the enterprise itself, three rationalization suggestions are put forward.

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Note: The subject of this article is the Business School at Chengdu University of Technology.