Proceedings of the 2nd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/47/20230400

Valuation Analysis of Lithium Battery Industry: Evidence from Kedali

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Abstract: In order to solve the problems of energy security and environmental pollution, governments are promoting the development of new energy industries to ensure the sustainable development of the human world. Among the new energy idustries, lithium batteries, as an important part of new energy vehicles, have widely used in recent years with the rise in sales of new energy vehicles. In China, with the increasing competition in the industry, various companies have different performances, and their business conditions affect the development of the entire new energy industry. Therefore, it is very necessary to build a reasonable value evaluation system for lithium battery companies to help related enterprises develop healthily and continue to operate, and market investors better understand the industry situation to make bright investment decisions. Based on the FCFF model, this paper analyzes the valuation of Kedali Company (one of the representative company in China's lithium battery industry), compares the intrinsic value of Kedali with the market value, and comes to the conclusion that the current stock price of Kedali is slightly undervalued. Finally, based on the conclusion, the investment risk analysis is presenetd for market investors, offering them some useful investment decisions.

Keywords: lithium battery industry, FCFF, investment risk

1. Introduction

With the coming of energy security and the environmental crisis, countries all over the world have taken a series of measures to reduce energy consumption and pollutant emissions. It has become an international consensus and a national strategy for China to develop new energy vehicles [1]. As well as the issuance of BYD's green debt notes, which will help the long-term development of new energy enterprises and the realization of China's double carbon targets [2]. According to GGII data, in 2022, the shipment of power lithium battery in China will be 480 GWh, more than doubling year-on-year. Benefiting from the rapid growth of downstream lithium battery shipments, the market scale of lithium battery structural parts in China will increase by 93.2% year-on-year in 2022, reaching 33.8 billion yuan. For power lithium battery structural parts, a complete industry chain has been formed in China, and a number of new energy battery head enterprises with international competitiveness and leadership positions have emerged, such as Ningde Time and Kedali.

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The most important link in the industrial chain of new energy vehicles is the industrial structure of the battery and its patented technology. From the upstream raw materials to the downstream manufacturing process integration, the patented technology is used to varying degrees, which affects the performance of the battery, and then determines the cruising range, safety and reliability of the vehicle [3]. The structural parts of the battery, including the top cover and shell, are the core components of the Li-ion battery and play a role in supporting, protecting and transmitting energy. The precise structural components of the battery mainly play the roles of energy transfer, electrolyte carrying, safety and battery fixed support. The battery box connector of new energy vehicle has specific functions such as connection ability, impact resistance, heat dissipation, anti-corrosion, anti-interference and anti-static. The research on its fault-tolerant structure fully shows the important influence of the battery structural components on safety [4].

This study pays attention to the combination of theory and practice. Through the analysis of the structural parts industry from large to small, and the analysis of the relevance and development of its upstream and downstream industries, this paper analyzes the enterprise valuation of Kedali by using valuation models (FCFF and relative valuation model) and comparing the absolute value evaluation method and the relative value evaluation method between absolute valuation method and relative valuation methods. The financial statements are used to analyze Kedali's profitability and provide a reference for cash flow prediction in the evaluation process. The analysis of the intrinsic value of Kedali was carried out through a discounted free cash flow model, while the relative valuation method was selected to assess the value of the enterprise. The above analysis can be used to realize a comprehensive analysis of the value of investment enterprises in Kedali.

An extensive literature research provides an understanding of the relationship between basic company data and stock price changes. Next, through summary and induction, the current research objects and research methods are summarized. A basic understanding of the research direction of the structural components industry and the investment value of Kedali Corporation is provided, which also provides theoretical support for the research of this paper [5, 6]. Previously, Lu thought that the FCFF model can avoid some accounting problems, such as manipulation of data and so on. As a result, the FCFF model can conduct a comprehensive valuation of the enterprise [7]. Li argued that the future value of the business is equal to the sum of all future discounted cash flows if the operation of companies is sustainable [8]. Chen and Liu used WACC as the whole discount rate of the enterprise, indicating that it can better reflect the necessary rate of return required by all investors of the enterprise [9]. Hu and Feng stated that investments should avoid the behavior of overconfidence and select the investment ratio according to their own risk performance [10].

Based on the research theme and literature, this paper finally chooses Kedali, a leading company in the structural parts industry of new energy battery, as the research object. Firstly, it makes a fundamental analysis of Kedali, and makes a valuation analysis based on its financial statement data of the past five years to determine its investment value, so as to provide reference for investors' decision-making. Following the theory of investment value analysis, this paper analyzes the industrial, financial and macro-environment of Kedali, and uses the valuation models to determine the investment value range [5]. A reasonable valuation of listed automotive battery companies not only opens up green financing channels for automotive battery companies that master core technologies, but also guides capital market investors to focus on automotive battery technology-based companies with real growth potential and promotes the maturity of China's capital market [6].

2. Overview of Stock Valuation Theory

Free cash flow to the firm (FCFF) means the cash flow is created after the normal production and operation of a company, which can show the ability of a company’s profitability. Among the evaluation of enterprise value, free cash flow is widely recognized as one of the mainstream indicators.

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FCFF can avoid the defects of accounting profit and operating cash flow indicators in evaluating enterprise value, and comprehensively consider the shareholders' equity and sustainable operation factors in order to analyze the long-term development potential of the company based on the value creation ability [7]. Hence, this paper uses FCFF model to evaluate the stock value of Kedali Company, and reflect the enterprise value. The basic theory of this model is: under the assumption of the sustainable development of a company, the future value of the company is equal to the discounted sum of all future free cash flows [8].

In this paper, FCFF model is roughly divided into three major steps. The first step is to confirm the discount rate of the company as a whole. Since the weighted average cost of capital is the weighted average obtained by calculating various financing methods of the enterprise in proportion, and the free cash flow of the enterprise is represented by the residual income, which can be used by shareholders and creditors, so according to the matching principle, the discount rate should be reflected in the necessary rate of return required by all investors (shareholders and creditors) of the enterprise, that is, the weighted average cost of capital of the enterprise [9]. The calculation formula is WACC=Kd(1-T)D/(D+E)+KeE/(D+E). Here, Kd is the cost of debt capital, Ke is the cost of equity capital, T is tax rate, D is total debt and E is total equity. The second step is to predict the free cash flow. In this paper, FCFF model is used to predict the cash flow that the company as a whole can create after operation. The calculation formula is FCFF=EBIT(1- Tax rate)+ Depreciation and amortization-Capital outlay-Working capital changes. After calculating FCFF, and choose WACC as the discount rate of the company as a whole, all future FCFF of the company can be discounted and summed to get the intrinsic value of the company. The calculation formula is Terminal Value=[FCFFn(1+g)]/(WACC-g). Due to the rapid growth of the operating income of Kedali Company in the past five years, this paper selects the principle of conservative estimation and uses the financial data of the company in the past ten years for analysis, in order to reduce the deviation of valuation.

3. Free Cash Flow Valuation Model

3.1. Determination of Discount Rate

In this paper, WACC is used as the weighted average cost of capital of enterprises, and its formula is a mentioned above. CAPM is used to calculate the cost of the equity capital of Kedali Company, and its formula is as Ke=Rf+β(Rm+Rf). Here, Ke is cost of equity capital; Rf is risk-free rate of return; R is market return; (Rm+Rf) is risk premium and β is market beta. Due to the stable social and economic development of China and the good reputation of the government, this paper selects the 30-year Treasury bond yield of 2.84% announced by the People's Bank of China on December 31, 2022 as the risk-free rate of return. According to the practice of most domestic scholars, Chinese GDP growth rate of 3% in 2022 is selected as the market risk premium. On December 30, 2022, the β of Kedali was 0.51 (nearly 100 weeks), which was found in East Money Net, in order to reflect the average risk coefficient of the whole year of 2022, this paper divides the coefficient by 2, and gets the average risk coefficient of 2022 is 0.25, so 0.25 is the equity capital market multiplier.

This article evaluates the company's 2022 situation based on the data from the Kedali 2022 annual report. In 2022, Kedali's short-term borrowings are ￥1816,439,358.94 and long-term borrowings are ￥257,800,000. According to the benchmark interest rate of RMB loans announced by the People's Bank of China in 2022, the one-year rate is 3.65%, and the five-year rate is 4.30%, so the debt capital is 3.97%. Kedali enjoys the preferential tax rate of 15% of national high-tech enterprises, so the income tax rate is 15%. This article uses Kedali's closing price and total share capital of December 30, 2022 to calculate total equity, and obtains total debt based on Kedali's 2022 annual report, E=58.28 (billion￥), D=83.47 (billion￥) and the WACC is 3.47%.

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3.2. Free Cash Flow Forecast

Due to the rapid growth of Kedali's operating income from 2018 to 2022, there is a large deviation from the forecast results. Therefore, this paper uses the operating income data of Kedali's annual report from 2012 to 2022 as the basis to forecast the operating income in the next three years, and the data are summarized in Table 1. The average growth rate of operating income in the past ten years can be calculate from the Table 1, i.e., 36.21% and the operating income forecast for the next three years will be based on this growth rate, as shown in Table 2.

Table 1: 2012-2022 Revenue data of Kedali.

Year	Revenue(billion ￥)	Income growth rate
2012	5.38	21.12%
2013	5.94	10.46%
2014	6.74	13.43%
2015	11.33	68.03%
2016	14.55	28.45%
2017	14.25	-0.25%
2018	20.00	37.80%
2019	22.3	11.48%
2020	19.85	-10.98%
2021	44.68	125.06%
2022	86.54	93.70%

Table 2: 2023-2025 Revenue forecast of Kedali.

Year	Revenue(billion ￥)	Growth rate
2023E	117.875	36.21%
2024E	160.556	36.21%
2025E	218.693	36.21%

Table 3: 2012-2022 Kedali expenses as a percentage of revenue.

Year	Operating cost/Revenue	Taxes and surcharges/ Revenue	Selling cost/ Revenue	Administration cost/ Revenue
2012	89%	0.74%	1.12%	8.74%
2013	88%	0.84%	1.18%	9.43%
2014	87%	1.04%	1.34%	9.64%
2015	84%	0.71%	1.15%	7.77%
2016	81%	0.82%	1.51%	7.77%
2017	92%	0.56%	2.60%	9.68%
2018	96%	0.65%	2.25%	4.30%
2019	87%	1.08%	2.33%	4.17%
2020	86%	0.81%	2.17%	4.38%
2021	85%	0.72%	0.31%	3.29%
2022	87%	0.50%	0.39%	2.72%
Average	88%	0.77%	1.49%	6.53%

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By analyzing each cost as a percentage of revenue, the average percentage over the past ten years can be calculated as given in Table 3. However, it is worth noting that over the past five years, the proportion of selling cost and administrative cost to revenue shows a declining trend, so this paper chooses 1% and 3% of selling and administrative cost to revenue for Kedali in the next three years. In addition, because of the small proportion of financial costs in revenue, this paper uses 1% in the next three years. Finally, the EBIT of Kedali in the next three years can be calculated, as shown in Table 4.

Table 4: 2023-2025 EBIT of Kedali. Unit: billion ￥

Year	2023E	2024E	2025E
Revenue	117.875	160.556	218.693
Operating cost	94.30	128.45	174.95
Taxes and surcharges	0.91	1.24	1.68
Selling cost	1.18	1.61	2.19
Administration cost	3.54	4.82	6.56
Financial cost	1.18	1.61	2.19
EBIT	16.77	22.85	31.12

Table 5: 2012-2022 Kedali's capital expenditure and proportion.

Year	Capital expenditure	As a percentage of revenue
2012	0.33	6.13%
2013	0.48	8.08%
2014	0.52	7.72%
2015	1.34	11.83%
2016	3.23	22.20%
2017	6.33	44.42%
2018	5.19	25.95%
2019	5.03	22.56%
2020	4.45	22.42%
2021	11.83	26.84%
2022	23.82	27.52%

Capital expenditures include cash payments which were used on structure fixed assets, intangible assets and other long-term assets. According to the historical data analysis in Table 5, Kedali's capital expenditures as a percentage of revenue averaged 20.48%. However, as the power battery market is expected to have excess capacity, the company will reduce investment in the construction of factories, so this paper forecasts capital expenditures will account for 15% of operating income in the next three years. According to the proportion of 15%, the capital expenditure of Kedali in the next three years can be calculated as listed in Table 6.

Table 6: 2023-2025 Kedali’s capital expenditure forecast.

Year	2023E	2024E	2025E
Revenue	117.875	160.556	218.693
Capital expenditure	17.68	24.08	32.80
As a percentage of revenuue	15%	15%	15%

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Through the analysis of depreciation and amortization data from 2012 to 2022, the ratio of depreciation and amortization to operating income of Kodali is relatively stable, with an average ratio of 5.84%, which can be used as the forecast proportion for the next three years (seen from Table. 7). According to the historical data analysis of previous years, the average growth rate of working capital is 39%, but as the amount of working capital in the past five years has fluctuated greatly, this paper uses a conservative estimate of 20% average growth rate to calculate the working capital and its increase in the next three years (as given in Table. 8).

Table 7: Kedali's depreciation and amortization.

Year	Depreciation and amortization	As a percentage of revenue
2012	0	0
2013	0	0
2014	0.27	4.01%
2015	0.33	2.91%
2016	0.45	3.09%
2017	0.75	5.26%
2018	1.16	5.80%
2019	1.71	7.67%
2020	2	10.08%
2021	2.61	5.84%
2022	4.06	4.69%
2023E	0.91	5.84%
2024E	1.24	5.84%
2025E	1.68	5.84%

Table 8: Working capital forecast of Kedali.

Year	Working capital	Increase in working capital
2012	1.57	
2013	1.84	0.27
2014	2.97	1.13
2015	2.71	-0.26
2016	1.87	-0.84
2017	7.37	5.50
2018	6.3	-1.07
2019	4.83	-1.47
2020	12.61	7.78
2021	9.94	-2.67
2022	5.56	-4.38
2023E	6.67	1.11
2024E	8.01	1.33
2025E	9.61	1.60

3.3. Calculation Results

Based on the above forecast data and combined with the FCFF calculation formula, the free cash flow of Kodali from 2023 to 2025 can be calculated, as shown in Table 9. FCFF=EBIT(1- Tax rate)+ Depreciation and amortization-Capital outlay-Working capital changes. For the calculation of free cash flow in the sustainable growth period, the following formula is adopted in this paper Terminal

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Value=[FCFFn(1+g)]/(r-g) Assuming that the future growth of Kedali as same as the growth rate of China's GDP in 2022, so the g is 3%; Substituting the FCFF present value and WACC value for 2023 into the formula yields 408.44(billion ￥). According to the data of Kedali 2022 annual report, the total share capital of the company in 2022 is 230 million, so the share price of Kedali in 2023 is 177.58 yuan. The closing price of Kodali on December 30, 2022, was 118 yuan/share. In this paper, the sustainable profit growth rate g and WACC are taken as variables, and the variation range of both is 0.5%. The sensitivity analysis of the equity value per share of Kedaly is shown in Table 10. From the sensitivity analysis of equity value per share, it can be seen that the stock price range of Kodali Company is [33.12,177.68] yuan/share, and the internal value calculated by FCFF model is 177.58 yuan/share within this range.

Table 9: 2023-2025 FCFF of Kedali. Unit: billion ￥

Year	2023E	2024E	2025E
EBIT	16.77	22.85	31.12
Income taxes rate	15%	15%	15%
Depreciation and amortization	6.46	8.08	11.99
Increase in working capital			
Capital expenditure	1.11	1.33	1.6
FCFF	17.68	24.08	32.80
WACC	1.93	2.81	4.04
FCFF PV	3.47%	3.47%	3.47%
	1.86	2.71	3.90

Table 10: Kedali valuation sensitivity analysis.

Sensitivity test result		WACC				
		2.47%	2.97%	3.47%	3.97%	4.47%
g	2.0%	177.68	85.65	56.23	41.74	33.12
	2.5%	-2797.3	177.64	85.63	56.21	41.72
	3.0%	-159.11	-2796.5	177.58	85.6	56.19
	3.5%	-82.27	159.06	-2795.4	177.52	85.57
	4.0%	-55.65	-82.24	-159.01	-2794.6	177.45

4. Investment Risks Analysis of Kedali

4.1. External Risks

As an upstream supplier of lithium battery structural components, Kedali' s development is closely related to the overall operation of the macro economy. At present, there is uncertainty in macroeconomic development at home and abroad, and the changes in the macro situation in the future will affect the company's operations. If the macroeconomic situation continues to be sluggish, it will first impact the downstream lithium battery and new energy vehicle industry, indirectly affecting the company's performance and financial situation. At the same time, the company's main operation is also related to the policy support of downstream lithium batteries and new energy vehicles. If the future relevant industrial policies do not support the lithium battery and new energy vehicle industries to meet expectations, the growth rate of demand for the company's products in the downstream industry will slow down, which will also lead to the decline in the company's performance and damage to its financial situation. Therefore, the risk of macroeconomic fluctuations and policy

DOI: 10.54254/2754-1169/47/20230400

changes is reflected in the company's expectations for the future. If the company cannot reasonably anticipate the existence of changes, its intrinsic value will shrink, and stock prices will fall.

Kedali implements the strategy of major customers in key areas, that is, to achieve the rapid development of the company through close cooperation with major customers. The market share of the power battery industry in the downstream application field of the company is concentrated, resulting in a high concentration of the company's customers. If the company's main customers are affected by industrial policies or other reasons, it will affect the stability of the company's cooperative relationship with the main customers, and the customer's demand for the products will decline. Finally, it will affect the company's performance and financial situation. The company's products serve the downstream lithium battery industry, but lithium batteries are not completely pollution-free energy. It only transfers the pollution link to the manufacturing link and does not fundamentally solve the pollution problem. However, hydrogen fuel cells will not cause pollution when manufacturing and using. At present, China restricts the development of hydrogen fuel cells and defines hydrogen as a kind of dangerous chemical. However, once the hydrogen fuel cell is matured and the safety and stability are improved, it will pose a great threat to the development of lithium batteries. Finally, the failure of the upstream company's operation will affect the company's performance and financial situation.

4.2. Internal Risk

The main factors affecting the company's gross profit margin are sales volume and raw material prices. On the one hand, if the company's upstream power lithium battery and new energy vehicle industry do not develop as expected, the new production capacity will not be effectively digested. Then, the excess inventory and fixed assets will be depreciated, and the main business revenue will decline. On the other hand, the company are highly dependent on raw materials such as aluminum, copper and other commodities. If the price of them rises in the future, it will raise the cost of the main business. Finally, if the company is insensitive to these two important factors, it will compress the gross profit and lead to a decline in the gross profit margin.

Kedali belongs to the manufacturing industry, and the proportion of fixed assets in the balance sheet is high. When the company invests in new projects, the capital required for investment in fixed assets such as R&D equipment and production equipment is huge, and the investment cycle of each project is long. Therefore, it takes a long time to produce economic benefits, and the actual benefits generated may be under the expectation. Finally, in the early stage of the project, the increase in depreciation of fixed assets may affect the company's performance.

The company's products are mainly lithium battery shells, which need to have high safety and high reliability. At the same time, its products are highly personalized. Therefore, as a technology-driven enterprise, it must grasp the technology research and development ability to adapt to market changes and satisfy customers. If the company's technology research and development capabilities are weakened, it will face a crisis that cannot satisfy the needs of customers for new technologies and products. Finally, company's production and operation are seriously affected [10].

5. Conclusion

In summary, the scientific and reasonable investment concept can help investors reduce investment risks and calculating the range of the most reasonable intrinsic value, for a company, not only needs to predict the future business situation, but also needs to combine many factors such as the company’ s management ability, industry, macroeconomic situation and possible risks and challenges. At the same time, it also needs to select an appropriate and reasonable valuation method. This article takes Kedali Limited Liability Company as an example. It uses the fundamental analysis method to analyse

DOI: 10.54254/2754-1169/47/20230400

the feasibility of the investment of Kedali Limited Liability Company from multiple angles, and it uses the absolute valuation method to estimate the intrinsic value of the company. Finally, it analyses the challenges that the company may encounter from both external risks and internal risks when investing. The investment suggestions are as follows.

First, for the lithium battery structural components industry. The government should be far-sighted. On the one hand It should pay attention to the close relationship between the lithium battery structural parts industry and the lithium battery and the new energy vehicle industry. On the other hand, it should recognize the important role of the development of lithium battery structural components in promoting high-quality economic development and building the international competitive advantage of China's new energy industry. Therefore, the government should supply more supports, formulate innovative and incentive policies, and finally promote the healthy and sustainable development of the lithium battery structural components industry. Second, Kedali has considerable advantages in terms of corporate background, financial situation and development potential. However, it needs to maintain a stable cooperative relationship with customers, because Kodali implements a major customer strategy. So, it requires company's lithium battery structural components and other products to be fully competitive in the market. Based on the fact, company should increase investment in R&D, promote product renewal and iteration and create more advantageous products. At the same time, company should optimize its capital structure and maintain sufficient free cash flow. Third, investors should decide the proportion of investment according to their own preferences. Driven by the growth of demand for lithium batteries and new energy vehicles, the lithium battery structural components industry has strong investment potential. After the analysis of this article, it is concluded that the current price of Kedali's stock is lower than the intrinsic value of the company, so it has the value of long-term holding. According to Separation Theorem and the characteristic of risky assets, investors should choose the investment ratio according to their risk preference. At the same time, investors also need to be cautious to deal with information because of the behavior of overconfidence. Therefore, they should not only see the known investment advantages, but also see the struggles and frictions within the market, focus on the macro and microeconomic situation, and make decisions to maximize utility. As the development of valuation research, the valuation theory will be more perfect. Then valuation for listed companies will be more accurate. This article is valued through Kedali Limited Liability Company. On the one hand, it hopes to provide reference for investors' investment, and on the other hand, it hopes to improve the company's supervision and governance, and ultimately promote the sustainable development of China's securities market.

Author Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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