

Enterprise Valuation and Analysis of New Energy Vehicles

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Abstract

This paper takes BYD Co., Ltd. as an example to study the valuation of new energy vehicle companies, and compares and analyzes the differences between the traditional valuation model and the B-S model based on the perspective of real options. The results show that, compared with the discounted cash flow model, the enterprise value of new energy vehicles evaluated from the perspective of real options is closer to the actual value of enterprises, and the research results of B-S model suitable for evaluating the enterprise value of new energy vehicles are obtained.

Keywords

New Energy Vehicle Enterprises; Business Valuation; Real Options Perspective; B-S Model.

1. Introduction

In recent years, the world's energy shortage and environmental problems have become increasingly serious, and countries have introduced a series of policies related to energy conservation and emission reduction to actively promote the development of green economy. In this context, the development of the new energy vehicle industry has ushered in new opportunities. In order to support the development of new energy vehicle enterprises, the Chinese government has listed new energy vehicle enterprises as strategic emerging enterprises to be vigorously supported. On August 1, 2022, the Ministry of Industry and Information Technology, the National Development and Reform Commission, and the Ministry of Ecology and Environment jointly issued the "Implementation Plan for Carbon Peaking in the Industrial Sector", which proposes to vigorously promote new energy vehicles and increase the concentration of the new energy vehicle industry, and by 2030, the proportion of new energy and clean energy-powered vehicles in that year needs to reach about 40%, and the carbon dioxide emission intensity of passenger cars and commercial vehicles needs to be reduced by more than 25% and 20% respectively compared with 2020. Therefore, the new energy vehicle industry has great development potential as a strategic emerging enterprise. In the process of continuous development and growth, business activities such as mergers and acquisitions will also follow. Therefore, a scientific and reasonable assessment of the enterprise value of new energy vehicles is conducive to the implementation of business activities such as mergers and acquisitions, so as to achieve a win-win situation for both parties.

2. Characteristics of the New Energy Vehicle Industry

2.1. It Can Reduce the Use of Petroleum Energy

In 2022, China's oil consumption will be 715 million tons, and the total oil production will be 205 million tons, while the import of oil will be 508 million tons, of which imported oil will account for 71.05%. According to figures provided by the Energy Foundation of the United States, China's motor vehicles consumed 85% of the country's total oil production in 2022, and

it can be seen from the data that China's motor vehicles account for a large proportion of petroleum energy consumption. Since the development of new energy vehicles can reduce the consumption of this part of energy, in order to maintain the long-term stability of China's oil supply, the development of new energy vehicles is the general trend.

2.2. The Investment Cost is High

As a strategic emerging industry vigorously supported by our country, new energy vehicle enterprises are also a kind of capital-intensive enterprises, which need to invest a lot of money in the early stage of enterprise development to develop new products and new technologies, and as an important material for new energy batteries, lithium, cobalt, nickel and other mineral resources, the price has been in a state of high status, which has caused the new energy vehicle manufacturing budget to continue to rise.

2.3. Long Payback Period

In the early stage of starting to build a new energy vehicle enterprise, a lot of money was invested due to the need to introduce advanced production technology and purchase related facilities and equipment. However, a large amount of money spent by new energy vehicle companies on production technology and R&D expenses takes a long time to recover, which means that there may be insufficient funds to affect the investment of enterprise funds, and further affect the technological innovation of enterprises.

3. Limitations of Traditional Valuation Methods for the Valuation of New Energy Vehicle Companies

Traditional business valuation methods include the income approach, the cost approach, and the market approach. The income method is to discount the expected earnings of an evaluated enterprise to a specific date to determine the value of the enterprise, mainly including the discounted cash flow method and the EVA valuation method. The cost method is based on the balance sheet of the enterprise and determines the value of the enterprise by evaluating the various assets and liabilities of the enterprise. The market approach refers to finding a traded company in the market that is similar to the company and comparing it to determine the value of the evaluated company. Due to the difficulty of finding comparable companies in the market, the market method is not adopted to evaluate the enterprise value of new energy vehicles; In addition, the cost method is applicable to enterprises with many tangible assets and high fairness of asset value, while new energy vehicle enterprises are technology-intensive enterprises, so the cost method is not applicable to the valuation of new energy vehicle enterprises; Moreover, the EVA model is usually used for the valuation of state-owned enterprises, but the proportion of state-owned enterprises in the listed enterprises of new energy vehicles is very small, so only the discounted cash flow method can be applied to the valuation of new energy vehicle enterprises in the traditional enterprise valuation method.

4. Comparative Analysis of Enterprise Value Evaluation of New Energy Vehicles

4.1. Comparative Analysis of the Valuation of BYD Co., Ltd

4.1.1. Valuation Analysis of Discounted Cash Flow Models

This study uses a discounted cash flow model to evaluate the value of BYD, and the specific formula is as follows:

$$V = \sum_{t=1}^n \left(\frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{t+1}}{(1+WACC)^n \times (WACC-g)} \right) \quad (1)$$

$$WACC = R_e \frac{E}{D+E} + R_d(1-T) \frac{D}{D+E} \quad (2)$$

$$R_e = R_f + \beta(R_m - R_f) + R_c \quad (3)$$

According to BYD's financial statements for the past 5 years (2018-2022), the company's free cash flow is forecast for the next 5 years. Due to the steady growth of the company's operating income in recent years, the average growth rate of operating income in BYD's income statement from 2018 to 2022 is selected as the forecast value, so as to forecast the operating income; In addition, there is a high correlation between costs and expenses and revenue, so the estimated costs and expenses are estimated using the sales percentage method, and the arithmetic weighted average of operating costs, taxes and surcharges, selling expenses, management expenses, accumulated depreciation and accumulated amortization are 84.05%, 1.47%, 3.33%, 2.78%, 5.13% and 1.35%, respectively. BYD enjoys different degrees of preferential tax policies, and in order to facilitate the calculation, the income tax is calculated at 20%; The proportion of capital expenditure and working capital increase in operating income is also relatively stable every year, but the proportion of capital expenditure in operating income in 2021 is too high, so the arithmetic average of the past 6 years (2017-2022) is selected for forecasting, respectively: 12.14% and -1.30%; Through the calculation, it can be seen that the proportion of accumulated depreciation and accumulated amortization in operating income is relatively stable every year. Therefore, the percentage method of sales revenue is used to calculate, and the weighted average of the past 5 years is used as the forecast value; After substituting the formula, BYD's free cash flow for the next 5 years (2023-2026) is shown in Table 1. The enterprise risk coefficient β queried through Guotaian data takes the value of 1.56. The forecast period is 5 years, and the risk-free rate is 2.64% as of December 31, 2022. The cost of debt is issued by the People's Bank of China as a five-year LPR of 4.3% for R_d and 4.92% for R_m . According to equation (2)(3). $R_e=2.64\%+1.56*(4.92\%-2.64\%)=6.20\%$, and cost of equity capital $WACC=6.20\%*75.42\%+4.3\%*(1-20\%)*24.58\%=5.53\%$. The discount rate is used to discount BYD's free cash flow for the next five years to obtain the present value of cash flows for each period in Table 1.

The growth rate of a company's perpetual annuity is generally expressed as the growth rate of gross domestic product (GDP). Therefore, this paper selects the percentage of the secondary industry to GDP from 2017 to 2020, and the query in the Guotaian database shows that they are 2.32, 1.94, 1.02, 3.1, and 3.8, respectively, and the average value is 2.44%. Therefore, this paper selects 2.44% as the growth rate of BYD's perpetual annuity. Therefore, the present value of BYD's second phase is: $PPV=256.96*(1+2.44\%)/(5.53\%-2.44\%)(1+5.53\%)^5=6508.74$ (100 million yuan).

Adding the valuation of the first stage in the discounted cash flow model and the present value of the cash flow in the second stage, the enterprise value of BYD as of December 31, 2022 was 726.968 billion yuan.

Table 1. BYD Enterprise's 2023-2027 free cash flow forecast 100 million yuan

Project	2023	2024	2025	2026	2027
Operating income	5131.14	6208.68	7512.5	9090.13	10999.06
Operating costs	4312.72	5218.40	6314.26	7640.25	9244.71
Taxes and surcharges	75.43	91.27	110.43	133.62	161.69
Sales expenses	170.87	206.75	250.17	302.70	366.27
Management fees	142.65	172.60	208.83	252.71	305.77
EBIT	429.47	519.66	628.81	760.85	920.62
Income tax expense	85.89	103.93	125.76	152.17	184.12
Earnings after interest and taxes	343.58	415.73	503.05	608.68	736.50
capital expenditure	622.92	753.73	912.02	1103.54	1335.26
Operating current assets	3101.08	3736.81	4502.85	5448.45	6592.63
Operating current liabilities	2004.36	2415.25	2910.38	3507.01	4225.96
Increase in working capital	-66.70	-80.71	-97.66	-118.17	-142.99
Accumulated depreciation	263.23	318.51	385.39	466.32	564.25
Accumulated amortization	69.27	83.82	101.42	122.72	148.48
Free cash flow	119.86	145.04	175.5	212.35	256.96
Present value of cash flows	113.58	130.23	149.34	171.46	196.33

4.1.2. Valuation Analysis of the B-S Model

In order to take into account the current value of the enterprise and the value that the enterprise may create in the future, the real option method and the traditional valuation method are generally used for analysis. For new energy vehicle companies, which are greatly affected by policies and have high uncertainty about future development, the real option pricing model can reasonably assess the potential value of this part.

The main formulas of the B-S model are as follows:

$$C = S_0 [N(d_1)] - X e^{-rt} [N(d_2)] \tag{4}$$

$$d_1 = \frac{\ln\left(\frac{S_0}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}} \tag{5}$$

$$d_2 = d_1 - \sigma\sqrt{t} \tag{6}$$

Where C represents the option price; S₀ represents the value of the underlying asset; X represents the strike price of the option; σ indicates the volatility of changes in the price of the underlying asset; T represents the option exercise time, and R represents the risk-free rate.

The value of the underlying assets S₀ is taken from the total assets in the balance sheet at the end of 2022 of the enterprise of 493.861 billion yuan. Take the total liabilities at the end of the

period in the balance sheet of 2022 of 372.471 billion yuan as the present value of BYD's underlying assets, that is, the option strike price X. The risk-free rate is 2.64% for the five-year Treasury note as of December 31, 2022. When calculating the volatility of the underlying asset price change, the daily volatility in 2022 is calculated to be 4.81%, and the annual trading day is 243 days, resulting in an annualized volatility of $\sigma = 74.98\%$. The exercise time of the option is 5 years.

According to equation (5) and (6), $d1 = 1.0853$, $d2 = -0.5913$, $N(d1) = 0.8611$, $N(d2) = 0.2772$, and finally according to equation (4), $C = 4938.61 * 0.8611 - 3724.71 * e^{-2.64\% * 5} * 0.2772 = 3347.91$ (100 million yuan). The total value of BYD's enterprise, that is, the value of real options and the current value estimated by the discounted cash flow model, is 1,061.759 billion yuan, and the actual value of BYD in 2022 is 975.206 billion yuan.

4.2. Analysis of the Differences between the Two Valuation Methods

4.2.1. Valuation Results Variance Analysis

Through the calculation of the above two valuation methods, the valuation results of BYD Co., Ltd. are shown in Figure 1:

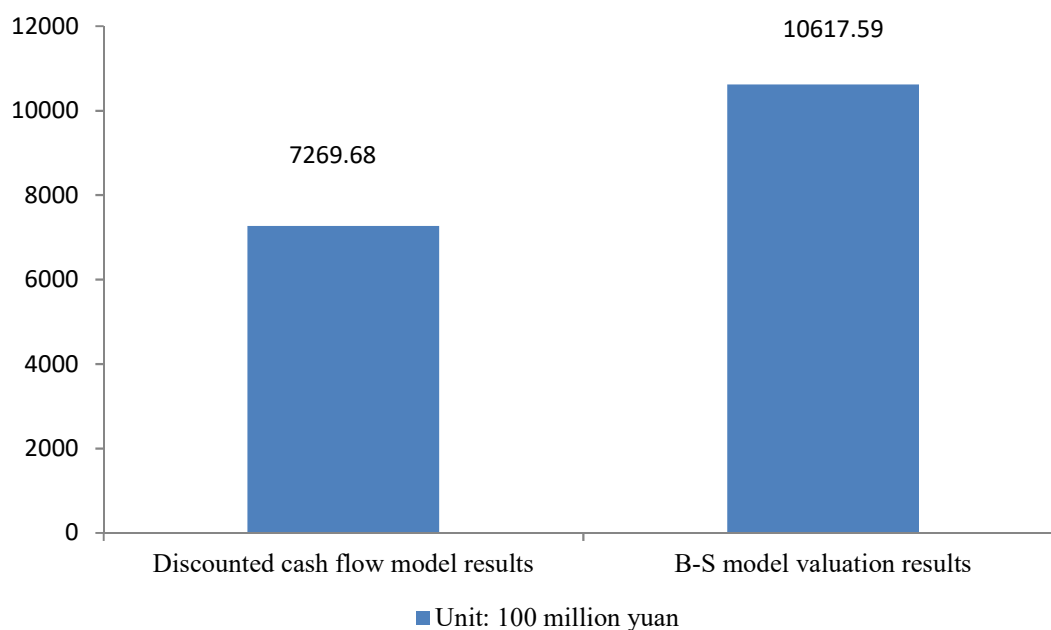


Figure 1. Comparative analysis of valuation results

Judging from Figure 1, the valuation result of the discounted cash flow model is 726.968 billion yuan, and the valuation result of the B-S model is 1061.759 billion yuan, a difference of 334.791 billion yuan, and the difference between the results is large. On December 31, 2022, the actual value of BYD's enterprise was 975.206 billion yuan, and the estimated result of the discounted cash flow model was obviously lower than the value of the actual enterprise, indicating that the discounted cash flow model did not predict the value and some hidden value brought by the risk to the enterprise, thus underestimating the value of the enterprise, but the B-S model just made up for this shortcoming.

4.3. Comparative Analysis of Enterprise Value Evaluation of New Energy Vehicles

An objective and fair assessment of the value of the enterprise is not only conducive to the correct understanding of the enterprise, but also provides a basis for the enterprise to make

core decisions on future development. With the development of the economy, mergers and acquisitions have become an important business strategy for enterprise expansion. As a strategic emerging enterprise, new energy vehicle companies are developing rapidly, and in order to expand the scale of enterprises, mergers and acquisitions have become the general trend. However, according to a large number of M&A case studies at home and abroad, it is found that most of the M&A cases are failures, and the research finds that the most critical factor for the success of M&A lies in the correct selection of the method of evaluating the value of the enterprise, and the adoption of traditional enterprise valuation methods will make the value of the acquired party's enterprise underestimated. In addition, a reasonable assessment of the value of new energy vehicle enterprises is conducive to guiding the flow of funds to more potential enterprises and promoting the development of the new energy vehicle industry. Therefore, in order to further test the accuracy of the discounted cash flow model and the B-S model in evaluating the enterprise value of new energy vehicles, this paper selects 12 domestic listed new energy automobile companies for calculation and analysis, as shown in Table 2:

Table 2. Comparison of valuation models of new energy vehicle companies

Company abbreviation	Actual value	Discounted cash flow valuation results	B-S Valuation Results
SAIC	2409.13	1332.15	5898.10
GAC Group	1571.14	-418.25	666.66
Great Wall Motors	1428.90	142.36	1255.09
King Long Motors	45.17	183.89	263.94
BAIC Blue Valley	431.73	-2424.22	-2175.84
JAC	378.35	-360.09	-61.78
Foton Motor	226.19	1272.43	1533.24
Dongfeng Motor	104.74	10.19	131.40
FAW Jiefang	478.91	-333.19	10.92
Hanma Technology	66.02	126.91	185.17
Jiangling Motors	140.79	1101.87	1253.56
Haima Motors	96.54	-22.66	111.11

Data source: Qianzhan Industry Research Institute.

The discounted cash flow model and B-S model for valuing BYD are also applied to the 12 listed new energy vehicles in China in Table 2, and the results show that: The B-S model is more suitable for new energy vehicle enterprises with large business scale, strong profitability, good development status and great future development potential, such as Guangzhou Automobile Group Co., Ltd. and Great Wall Motor Co., Ltd. The discounted cash flow model is more suitable for new energy vehicle companies with small operating scale, weak profitability and low future development potential, such as Dongfeng Motor Group Co., Ltd. and Hanma Technology Group Co., Ltd. Because the data chart in Table 2 is not intuitive, the actual market value, discounted cash flow model valuation results and B-S model valuation results of the 12 new energy vehicle

companies are made into a line chart as shown in Figure 2 to facilitate the comparison of the three. The smaller the scale of new energy vehicle enterprises, the difference between the results obtained by applying the discounted cash flow model and the B-S model valuation is very small.

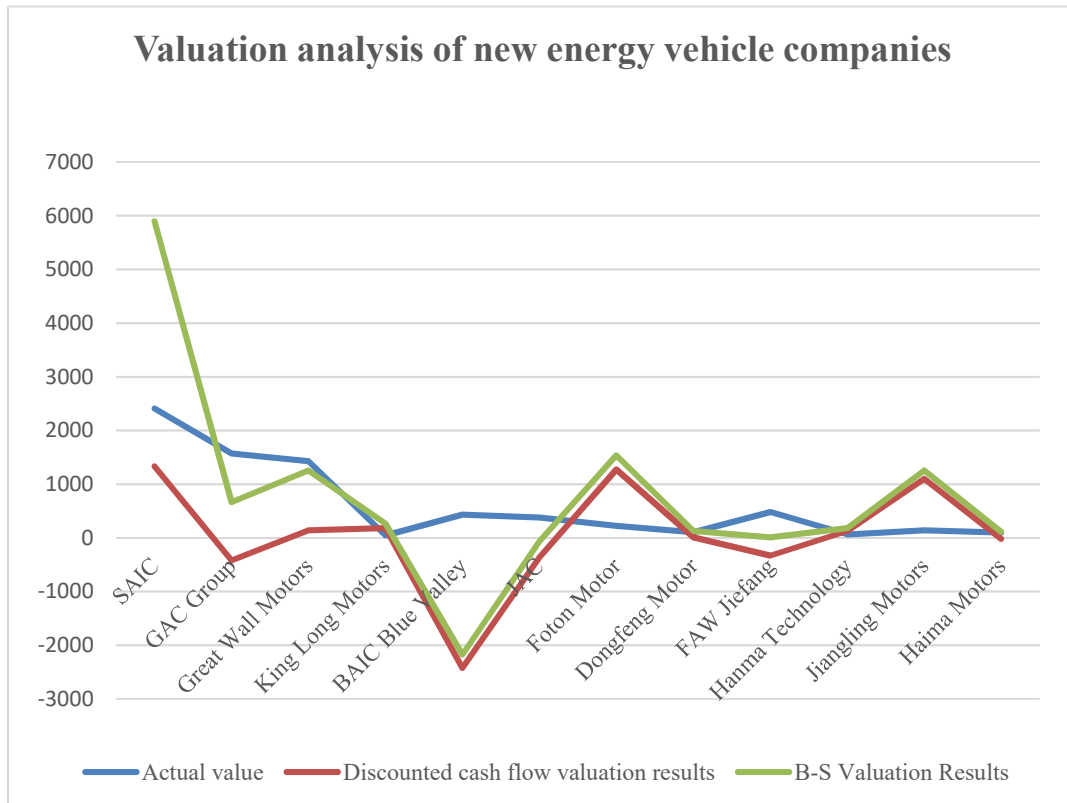


Figure 2. Comparison of valuation results of new energy vehicle companies

5. Research Implications

By using the discounted cash flow model and the B-S model to analyze the case of BYD, it is found that the overall value of the enterprise calculated by the B-S model is closer to the actual value of the enterprise, which reflects that the B-S model is more suitable for valuing BYD than the discounted cash flow model. In order to further study the valuation methods applicable to new energy vehicle enterprises, this paper applies two valuation models to 12 listed new energy vehicle companies in China. The results show that the discounted cash flow model is suitable for new energy vehicle enterprises with few uncertainties, small business scale, weak profitability and small future development potential, and the B-S model is suitable for new energy vehicle enterprises with many uncertainties, large business scale, strong profitability, good development status and great future development potential. In addition, industries such as biomedicine, photovoltaic power generation, and wind power generation, which are similar to new energy vehicle companies, have the characteristics of high investment, long recovery cycle and high risk, and whether the B-S model can be applied to the value evaluation of such enterprises also needs to be further studied and demonstrated.

References

[1] LI Bingxiang, REN Hanxiao. Valuation of big data assets[J]. Friends of Accounting, 2021(21):127-133. (In Chinese).

- [2] WANG Zhi, LI Xinlan. A Comparative Study on the Value Evaluation Models of Internet Enterprises[J]. Finance Theory & Practice, 2021, 42(05):75-82. (In Chinese).
- [3] Zheng Zheng. How to Scientifically Evaluate the Value of Real Options of NEEQ Enterprises: Based on Option Pricing Theory and Fuzzy Analytic Hierarchy Process Model[J]. Journal of Financial Regulation, 2020(11):83-99. (In Chinese).
- [4] CHEN Qiren, WANG Tianyun, OUYANG Rujia. Research on the Valuation Model of Growing Enterprises: A Case Study of the New Third Board[J]. Central Finance and Economics Journal of Chinese Universities, 2020(09):55-69. (In Chinese).
- [5] Dec Marcin. From point through density valuation to individual risk assessment in the discounted cash flows method[J]. International Journal of Finance & Economics, 2020(4).
- [6] William F. Sharpe. Capital Asset Prices : A Theory Of Market Equilibrium Under Conditions Of Risk[J]. The Journal of Finance, 1964, 19(3):425-442.