

Evaluation of the operating conditions of new energy automobile enterprises: a comparative analysis based on NPV method and IRR method

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Abstract. The world today is facing an energy crisis, and new energy vehicle companies, mainly electric vehicles, will account for a large proportion of the future automotive market. In investment decision-making, the two most popular approaches for determining whether project investment is viable are the NPV method. In this paper, the NPV method and IRR method are used to evaluate the operating conditions of new energy automobile enterprises, and the investment value of each enterprise is judged by the two indicators of net present value and internal rate of return. First, after obtaining the data through the financial reports of new energy automobile companies, then calculate the NPV and IRR, and finally compare the NPV and IRR of each company to judge whether it is worth investing. In the NPV method, the enterprise with the maximum NPV is selected; in the IRR method, the enterprise with the maximum IRR is selected.

Keywords: New energy vehicles; Net present value; Internal rate of return.

1. Introduction

As energy conservation, emission reduction and environmental protection become important directions for automobile development, combined with the "Made in China 2025" and the domestic policy of gradually banning the sale of fuel vehicles, new energy vehicles, mainly electric vehicles, will gradually Replacing traditional fuel vehicles to the stage of automobile history.

The world today is facing an energy crisis. The world's major energy sources include oil, natural gas, and coal. And these energy sources are limited and non-renewable. The fuel of traditional cars is mainly gasoline and diesel refined from petroleum. However, my country's oil reserves and extraction are very limited, and the greater the reserve of automobiles, the greater the dependence on imports of oil. In 2020, the number of cars in my country will be 200 million. It can be seen that energy security has brought great pressure to the development of our country, so our country's cars must increase the research and development of new energy vehicles [1].

With the continuous improvement of research in the field of new energy vehicles, more and more new energy vehicle companies will appear in the future. This paper uses the NPV method and IRR method to evaluate the operating conditions of new energy companies to help investors evaluate a new energy vehicle company. Whether it is worth the investment to make a judgment [2].

This paper selects part of the financial statement data of three domestic and foreign new energy automobile companies from 2017 to 2020, use the NPV approach to determine the difference between the present value of future capital inflows and outflows, and calculates the present value of capital inflows through the IRR method. The total value is equal to the total present value of capital outflow, and the discount rate when the net present value is equal to zero. By comparing NPV and IRR, we can evaluate the operating conditions of the three new energy automobile companies and give investment suggestions for investors [3, 4].

When using the NPV method, select the enterprise with the largest NPV value for investment; when using the IRR method, select the enterprise with the largest IRR value for investment.

The second part of this article introduces the definition, similarities and differences of NPV and IRR, and some financial report data of domestic and foreign new energy vehicle companies from 2017 to 2021; the third part introduces the operation of three new energy vehicle companies under the evaluation of NPV method and IRR method The status and comparison results; the fourth part is

the evaluation of the business status of new energy automobile companies: the conclusions drawn from the comparative analysis and research based on the NPV method and the IRR method[5, 6].

2. Methods and Data

2.1 NPV method

2.1.1 Definition

The fundamental indication of the net present value approach in project appraisal, net present value refers to the difference between the present value of future capital inflow and outflow. [7].

2.1.2 Formula

$$NPV = \sum Ct / (1+k)^t - C0 \quad (1)$$

In the formula: NPV - net present value

Ct - cash inflow

C0 - initial investment (cash outflow)

k——discount rate (that is, the discount rate predetermined by the enterprise)

t - time

2.2 IRR method

2.2.1 Definition

When the total current value of capital input and outflow is equal and the net present value is zero, the internal rate of return (IRR) is used as a discount rate. [2].

2.2.2 Formula

$$0 = \sum Ct / (1+k)^t - C0 \quad (2)$$

In the formula: Ct - cash inflow

C0 - initial investment (cash outflow)

k - internal rate of return

t – time

2.2.3 Similarities and Differences Between NPV and IRR

NPV is a dynamic evaluation index that reflects the total profitability of an enterprise in a period of time. In general, if $NPV \geq 0$, the operating condition is good; if $NPV < 0$, the operating condition is poor; when comparing multiple enterprises, the NPV is the largest is the firm with the best operating conditions. When enterprises select projects, they can also refer to the following characteristics of NPV:

1. A single value measuring index for the financial advantages of an investment project is the NPV index. It is created by forecasting the investment project's future cash flow, and its size is correlated with the project cash flow's size. For example, the magnitude of initial investment is 100,000, and the magnitude of NPV is 100,000;

2. NPV takes into account the time value of money. It passes through the discounting process, and the weight of recent cash flow is more important than the weight of long-term cash flow;

3. The amount of the project's net cash flow has no bearing on NPV. In addition, multiple benchmark rates of return can be used to compute NPV for each stage of the life cycle of the same project. It is unaffected by the number of changes in the sign of the net cash flow.

4. NPV can be used for comparison and selection of programs whose net cash flows are all negative in each period [3, 4].

IRR, on the other hand, is primarily a metric for assessing the norm for corporate investment profitability; it is the discount rate at which the firm may revert to profitability when the sum of its years' net cash flows over the calculation period equals zero. In general, the firm is in excellent shape if $IRR > \text{benchmark rate of return}$; if $IRR > \text{benchmark rate of return}$, the company's business is in

bad shape. Businesses can additionally take into account the following IRR characteristics when making project selections: 1. IRR is a comparative indicator used to assess the project's economic advantages. Its size is unaffected by the size of the net cash flow, meaning that the IRR is the same whether the net cash flow is measured in yuan or 10,000 yuan; 2. The time value of money is considered in the IRR calculation;

3. IRR involves the presumption that all project net income will be put back into the project. [8, 9].

2.3 Data

The following data is part of the financial report data of domestic and foreign new energy automobile enterprises from 2017 to 2021-taking Tesla (table1), BYD (table2), and NIO (table3) as examples.

2.3.1 Tesla

Table 1. Tesla's partial financial statements (Unit: thousands of dollars)

Year	0	2017	2018	2019	2020	2021
Profit		11,758	21,461	24,578	10,744	17,719
Cost		9,536	17,419	20,509	8,678	12,872
Gross profit		2,222	4,042	4,069	2,066	4,847
EBT		-2,209	-1,005	-665	379	2,635
Income tax		-31,546	58	110	83	292
Net profit		-2,240	-1,063	-775	296	2,343
Net operating cash flow		-60,654	2,098	2,405	3,019	4,585
Net investment cash flow	-1,416	-4,418	-2,337	-1,436	-1,047	-1,916
Net cash flow	-1,416	-25,302	312	2,506	4,898	1,450

2.3.2 BYD

Table 2. BYD's partial financial statements (Unit: RMB)

Year	0	2017	2018	2019	2020	2021
Profit		102,650,614	121,790,925	121,778,117	153,469,184	211,299,918
Cost		84,715,540	103,724,161	103,702,124	126,225,593	187,667,357
Gross profit		17,935,074	18,066,764	18,075,993	27,243,591	23,632,561
EBT		5,620,641	4,385,640	2,431,131	6,882,587	4,518,003
Income tax		703,705	829,447	312,274	868,624	550,737
Net profit		4,916,936	3,556,193	2,118,857	6,013,963	3,967,266
Net operating cash flow		6,367,887	12,522,909	14,741,007	45,392,668	65,466,682
Net investment cash flow	-13,421,402	-15,716,724	-14,230,760	-20,881,446	-14,444,248	-45,403,992
Net cash flow	-13,421,402	1,818,987	2,208,660	469,906	2,041,002	36,125,207

2.3.2 NIO

Table 3. NIO's partial financial statements (Unit: thousands of RMB)

Year	0	2017	2018	2019	2020	2021
Profit			4,951,171	7,824,904	16,257,933	36,136,423
Cost			5,207,047	9,023,726	14,384,514	29,314,990
Gross profit			-255,876	-1,198,822	1,873,419	6,821,433
EBT			-9,616,935	-11,287,764	-5,297,714	-3,974,684
Income tax			22,044	7,888	6,368	42,265
Net profit			-9,638,979	-11,295,652	-5,304,082	-4,016,949
Net operating cash flow			-7,911,768	-8,721,706	1,950,894	1,966,386
Net investment cash flow	-11,784,300	1,190,273	7,940,843	3,382,069	-5,071,060	-39,764,704
Net cash flow	-11,784,300	6,934,222	-4,306,466	-2,234,518	37,555,229	-20,170,534

3. Result

3.1 Result of NPV evaluation

Assume an industry benchmark discount rate of 10%

3.1.1 Tesla

From Table 1 Tesla's partial financial statement data from 2017 to 2021 can be obtained (unit: thousands of dollars):

Initial investment $C_0 = -1,416$

Subsequent cash flow $C_1 = -25,302$, $C_2 = 312$, $C_3 = 2,506$, $C_4 = 4,898$, $C_5 = 1,450$

According to the formula (1)

Calculated NPV = -18,031

3.1.2 BYD

From Table 2 BYD's partial financial statement data from 2017 to 2021 can be obtained (unit: thousand of RMB):

Initial investment $C_0 = -13,421,402$

Subsequent cash flow $C_1 = 1,818,987$, $C_2 = 2,208,660$, $C_3 = 469,906$, $C_4 = 2,041,002$, $C_5 = 36,125,207$

According to the formula (1)

Calculated NPV = 14,235,552

3.1.3 NIO

From Table 3, NIO's partial financial statement data from 2017 to 2021 can be obtained (unit: thousand yuan):

Initial investment $C_0 = -117,843$

Subsequent cash flow $C_1 = 6,934,222$, $C_2 = -4,306,466$, $C_3 = -2,234,518$, $C_4 = 37,555,229$, $C_5 = -20,170,534$

According to the formula $NPV = \sum C_t / (1+k)^t - C_0$

Calculated NPV = 14,074,518

3.2 Result of IRR evaluation

3.2.1 Tesla

From Table 1 Tesla's partial financial statement data from 2017 to 2021 can be obtained (unit: thousands of dollars):

Initial investment $C_0 = -1,416$

Subsequent cash flow $C_1 = -25,302$, $C_2 = 312$, $C_3 = 2,506$, $C_4 = 4,898$, $C_5 = 1,450$

According to the formula (2)

Calculate IRR = -1800%

3.2.2 BYD

From Table 2 BYD's partial financial statement data from 2017 to 2021 can be obtained (unit: thousand yuan):

Initial investment $C_0 = -13,421,402$

Subsequent cash flow $C_1 = 1,818,987$, $C_2 = 2,208,660$, $C_3 = 469,906$, $C_4 = 2,041,002$, $C_5 = 36,125,207$

According to the formula (2)

Calculate IRR = 29.97%

3.2.3 NIO

From Table 3, NIO's partial financial statement data from 2017 to 2021 can be obtained (unit: thousand yuan):

Initial investment $C_0 = -11,784,300$

Subsequent cash flow $C_1=6,934,222$, $C_2=-4,306,466$, $C_3=-2,234,518$, $C_4=37,555,229$, $C_5=-20,170,534$

According to the formula $0 = \sum C_t / (1+k)^t - C_0$

Calculate IRR=18.82%

3.3 Comparative analysis

3.3.1 NPV method

When the industry benchmark discount rate is 10%, it can be seen from the calculation that Tesla's NPV=-18,031,000, BYD's NPV=14,235,552, and NIO's NPV=14,074,518. The NPV of Tesla's cash flow is less than zero, the NPV of BYD and NIO's cash flow is greater than zero, and the NPV of BYD's cash flow is larger. When choosing the NPV method under the assumption that the industry benchmark discount rate is 10%, this paper recommends investors to invest in BYD first.

3.3.2 IRR method

It can be seen from the calculation that Tesla's internal rate of return IRR=-1800%, less than zero; BYD's internal rate of return IRR=29.97%, greater than zero; NIO's internal rate of return IRR=18.82%. By comparison, BYD has a higher internal rate of return (IRR). When choosing the IRR method, this paper recommends investors to invest in BYD first [10].

4. Conclusion

The research problem of this paper is the evaluation of the operating conditions of new energy automobile enterprises: a comparative analysis based on the NPV method and the IRR method. It can be seen from the above that when evaluating the operating conditions of the three new energy automobile companies using the NPV method and the IRR method, the conclusions given are all recommendations for investors to invest in BYD. The above conclusions are based on the assumption that the industry benchmark discount rate is 10%. When the net present value of the two companies being compared is not much different, the internal rate of return can be used as the assumption on which the business status indicator is based. Therefore, when investing The comparison and selection of time is more reliable. When the difference between the net present values of the two companies being compared is too large, the net present value is more in line with the goal of maximizing the benefits pursued by investment decisions. At this time, the NPV method is more reliable.

This conclusion can help investors better consider whether a new energy vehicle company is worth investing in based on its financial status in the future, and it can also help companies check their own financial status. The research may have the problem of insufficient sample data, which can be resolved after expanding the number of selected companies and selecting more years of financial statements.

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