Evaluation and Optimization of Financing Efficiency for New Energy Vehicle Enterprises

Ruixin Gong, Qinjin Jin, Xi Yang* and Shaojie Guan
School of Economics and Management, China University of Petroleum-Beijing, Beijing 102240, China

*Email: yangxi@cup.edu.cn

Abstract. This paper focuses on the financing efficiency of new energy vehicle enterprises, taking Chinese new energy vehicle enterprises as the research object through a combination of qualitative and quantitative methods. The main research conclusions are as follows: on the one hand, the overall financial support efficiency of listed new energy vehicle enterprises shows a time trend of "rising first and then falling", and the trend of debt financing efficiency is more stable than that of equity financing efficiency; on the other hand, explanatory variable coefficients are significantly negative and the marginal coefficient of equity financing is smaller than that of debt financing. Finally, combined with the research conclusions, specific suggestions for optimizing the financing structure for new energy vehicle companies and BYD are given.

1. Introduction
At present, the energy and environmental problems caused by traditional fuel vehicles are becoming increasingly prominent. New energy vehicles, with the characteristics of low energy consumption, zero pollution, low noise and convenient maintenance, play a pivotal role in alleviating the pressure of energy shortage, reducing air pollution and promoting the rapid penetration of alternative energy into transportation system[1]. China is one of the countries that promote the development of the new energy vehicle industry chain the most in the world. While Chinese new energy vehicle has the characteristics of high input costs, long investment cycles, high market operation risks and continuous capital supply, causing many new energy vehicle enterprises have high debt ratios and worrying financial situation[2]. New energy vehicle companies, like other strategic emerging companies, financial support is necessary to the development process[3]. Therefore, for Chinese new energy vehicle companies, how to choose the best financing strategy to reduce financing costs and risks, effectively alleviate financing difficulties and improve the efficiency of capital allocation is particularly important. This paper evaluates the financing efficiency of new energy vehicle companies and its influencing factors, then proposes optimization suggestions for the government, industry, and enterprise.

2. Methodology

2.1. DEA Model
DEA model is particularly suitable for new energy vehicle enterprises financial support, which has the feature of multiple input and multiple output indicators[4]. This paper adopts the investment-oriented BCC model with variable returns to scale combined with the variable data characteristics of new energy vehicle companies to measure the comprehensive efficiency, pure technical efficiency and scale
efficiency of financing by using DEAP software. The indicators selected in this paper are mainly financial indicators combined with the development feature of the new energy vehicle industry, the selected new energy vehicle listed companies’ financing efficiency input-output indicators are shown in Table 1.

Table 1. Input-output indicators for new energy vehicle companies’ financing efficiency

| Input indicators                   | Equity financing ratio |
|-----------------------------------|------------------------|
|                                   |                       |
|                                   | Equity financing cost  |
|                                   | Debt financing ratio   |
|                                   | Debt financing cost    |
| Output indicators                 | Return on equity       |
|                                   | Main business income growth rate |
|                                   | Total asset turnover   |

2.2. Logit Model

Based on the DEA efficiency value, we build the Logit model. The explained variable of the model is the efficiency value after processing the comprehensive technical efficiency of the DEA model. The processing principle is that if the comprehensive technical efficiency value of the sample enterprise is higher than the average efficiency value, it is recorded as 1, which means that the promotion of financing efficiency has been achieved; otherwise, the efficiency value is recorded as 0, which means that the promotion of financial support efficiency has not been realized. The explanatory variables are equity financing ratio $Er$, equity financing cost $Ec$, debt financing ratio $Br$, and debt financing cost $Bc$. The calculation of the Logit model is realized by STATA software.

2.3. Data Selection and Preprocessing

According to the feature of the new energy vehicle industry chain, new energy vehicle listed companies initially selected from charging equipment production, parts production and vehicle assembly respectively. On this basis, considering the availability, completeness and validity of the data, we eliminated incomplete data and ST-level companies and finally retained 35 representative new energy vehicle listed companies as research samples, with a time span of 2012-2018. The DEA model can be used to measure the financing of new energy vehicle companies effectiveness. All the original data are mainly from the CCER database and the annual financial reports of listed companies. The DEA model needs to be standardized before using the sample data.

3. Results and Analysis

3.1. Empirical Analysis

3.1.1. Financial Support Efficiency. From 2012 to 2018, the overall financial support efficiency of new energy vehicle listed companies fluctuated between 0.85 and 0.90, showing a trend of "rising first and then falling", as shown in Figure 1. Specifically, there was a slight increase from 2012 to 2014, while a decline after 2014. The decline in the following four years was slight, and the overall comprehensive efficiency was still higher than the level before 2014. Combined with the actual market situation, in the initial stage of the development of new energy vehicles, with strong national policy support and high enthusiasm for investment and financing in the market, the new energy vehicle industry has a large amount of financing and flexible and effective capital allocation. In 2014, Chinese new energy vehicle market showed explosive growth. With the cooling of the new energy vehicle market and the emergence of investment and financing risks, corporate funds have shrunk and the pace of development has slowed down.
3.1.2. Debt Financing Efficiency. From 2012 to 2018, the debt financing efficiency of listed new energy vehicle companies fluctuated in the range of 0.60~0.73, while the efficiency of equity financing fluctuated in the interval of 0.58~0.80. From 2008 to 2018, the average value of equity financing efficiency of listed new energy vehicles companies is 0.683, which is slightly higher than the debt financing efficiency as shown in Figure 2. The change trend of debt financing efficiency of listed new energy vehicle enterprises is more stable than that of equity financing efficiency, which may be related to the nature of debt financing. Debt financing is mainly based on bank credit, and the source of bank credit funds is relatively stable, which is not easily affected by investor preferences and market environment.

3.1.3. Logit Model Common Standard Error Regression. The Logit model common standard error regression results of panel data of 35 new energy vehicle listed companies from 2012 to 2018 are shown in Table 2, which reflects the impact of various financial input variables on the comprehensive technical efficiency of new energy vehicle listed companies. The LR statistic of the significance of the entire equation is 88.92, the P value is 0.000, which show that the entire equation is highly significant. In addition, by calculating the “percentage of correct predictions” as 76.33%, it can also be judged that the model has a higher goodness of fit. When the sample uses the robust standard error estimation, the result is close to the common standard error, and the explanatory variable coefficients are all negative, indicating that the equity financing ratio, equity financing cost, debt financing ratio, and debt financing cost will be greater and the probability that the overall efficiency value of the enterprise takes 1 will be smaller.
Table 2. The common standard error estimation result of the corporate financing efficiency Logit model

| y  | Coef.  | Std. Err. | z       | P>z |
|----|--------|-----------|---------|-----|
| er | -4.686963 | 1.22256  | -3.83  | 0.000 |
| ec | -4.6945  | 1.262994 | -3.72  | 0.000 |
| br | -7.132246 | 1.200703 | -5.94  | 0.000 |
| bc | -10.69333 | 2.66612  | -4.01  | 0.000 |
| _cons | 10.49781 | 1.491563 | 7.04   | 0.000 |

3.1.4. Logit model average marginal effect Based on the common standard error regression of the Logit model, after multiplying the coefficient of the explanatory variable by the conversion factor to convert the marginal effect, the average marginal effect of each explanatory variable can be obtained, as shown in Table 3. The model explanatory variable z test rejects the null hypothesis at the 99% confidence level, showing that the equity financing ratio, equity financing cost, debt financing ratio, and debt financing cost have a significant impact on the overall efficiency.

Table 3. 2012-2018 average marginal effect of the Logit model of corporate financing efficiency.

| dy/dx Delta-method | Std. Err. | z       | P>z |
|--------------------|-----------|---------|-----|
| er                 | -1.158279 | 0.3147991 | -3.68 | 0.000 |
| ec                 | -1.160142 | 0.3098624 | -3.74 | 0.000 |
| br                 | -1.762576 | 0.3328767 | -5.29 | 0.000 |
| bc                 | -2.642619 | 0.8291376 | -3.19 | 0.001 |

In order to test whether the empirical results have changed in other scenarios, we uses the Probit model instead of the Logit model to test the robustness from the perspective of changing the measurement method. According to Table 4, the equity financing ratio, equity financing cost, debt financing ratio, debt financing cost and financing efficiency of listed new energy vehicles are all negatively correlated. It is basically consistent with the Logit model estimation result, that is, the empirical result is robust.

Table 4. Model robustness test.

| y  | Coef.  | Std. Err. | z       | P>z |
|----|--------|-----------|---------|-----|
| er | -2.671548 | 0.6889535 | -3.88  | 0.000 |
| ec | -2.89571  | 0.7321788 | -3.95  | 0.000 |
| br | -4.156935 | 0.6374231 | -6.52  | 0.000 |
| bc | -6.160498 | 1.414828  | -4.35  | 0.000 |
| _cons | 6.17315  | 0.8002153 | 7.71   | 0.000 |

3.2. Case Study-Take BYD as an Example
As a researcher and promoter of new energy vehicles, BYD has strong capital, technology accumulation, leading and market share, who is in a leading position in the field of new energy vehicles. BYD's financing is measured by equity financing and debt financing[5].

3.2.1. BYD Comprehensive Efficiency of Financing Figure 3 shows the comprehensive financing efficiency of BYD and the new energy vehicle industry in 2012-2018. In the past seven years, BYD’s comprehensive financing efficiency value was greater than or close to the industry average efficiency value for four years, indicating that BYD’s new energy vehicle financing has some advantages. While
compared with the industry average value, there is still some gap and the potential to further improve the efficiency of factor allocation.

3.2.2. BYD Financing Pure Technical Efficiency

The average pure technical efficiency of financing of BYD and the new energy vehicle industry from 2012 to 2018 is shown in Figure 4. Overall, the pure technical efficiency of BYD's financing fluctuates around the average value of the new energy vehicle industry. In 2013 and 2017, it was far from the average pure technical efficiency value of the industry and its performance was poor, which shows that there are some problems in the operation and management of the new energy vehicle projects in the past two years. But through improvement, the pure technology efficiency value of BYD is finally improved.

3.2.3. BYD Financing scale efficiency

The average financing scale efficiency of BYD and the new energy vehicle industry from 2012 to 2018 is shown in Figure 5. It can be seen that the scale efficiency of BYD's financing was lower than the average scale efficiency of the new energy vehicle industry before 2015, while was higher than the average scale efficiency of the industry after 2015. To a certain extent, BYD's investment scale and investment structure are becoming more reasonable and getting closer to the optimal production scale.
Figure 5. 2012-2018 BYD's financing scale efficiency

4. Conclusions and Suggestions
The conclusions can be drawn based on the analysis: For new energy vehicle listed companies, the financial support efficiency has shown a time trend of "rising first and then falling", which is basically the same with overall change trend of all companies. The debt financing efficiency trend is more stable than equity financing efficiency. Furthermore, the explanatory variable coefficients are all negative and have a significant impact. The marginal coefficient of equity financing of new energy automobile companies is relatively small compared with debt financing. For BYD, its financing structure mainly has the following problems: the scale of financing is limited; the financing channels are relatively simple and the capital structure is improperly connected. There are several structural optimization suggestions for financing of new energy vehicle enterprises. For government, accelerate the improvement of the capital market system and moderately guide subsidy funds. For industry, form mature industrial clusters and closely follow the national industrial development plan. For enterprise, rationally arrange financing structure and actively innovate financing methods.

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