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Financial Performance Evaluation of Renewable Energy Vehicle Listed Companies in China Based on Factor Analysis

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Abstract:
The objective of this study was to evaluate the financial performance of renewable energy vehicle enterprises. First, we chose fourteen critical financial indicators reflecting profitability, growth capacity, operational capacity, and solvency from the financial statements of fifteen renewable energy vehicle companies in 2019. Next, we performed a factor analysis to construct a financial performance evaluation system using IBM SPSS Statistic 26. Finally, we analyzed the three extracted factors and the factors scores for each observation to study the companies' financial performance.

Key Words*: Financial Performance; Factor Analysis; Evaluation System; Renewable Energy Vehicle Companies.*

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I. Introduction

With the rapid development of global science and technology, the development and utilization of renewable energy have attracted a lot of interest in many countries. In China, vehicles have become an essential means of transportation for people. Vehicle demand increases with increasing energy consumption. The power source of renewable energy vehicles has many advantages, such as low carbon emission, environmentally friendly, and renewable. Hence, there has been a high-speed expending of the renewable energy vehicle industry in China. As an emerging and fast-growing industry, evaluation of the financial performance of renewable energy vehicle companies should make an essential contribution to the field of the renewable energy industry [1]. The study used the sample of fifteen renewable energy vehicle companies' financial indicators in 2019 to construct the financial performance system based on factor analysis and did an in-depth analysis of the factors impacting the companies' financial performance [2].

II. Data and Methodology

Fourteen financial indicators were gathered from fifteen renewable energy vehicle companies' financial statements in 2019. They reflected profitability, growth capacity, operational capacity, and solvency, as shown in table 1. To construct the financial performance evaluation system, factor analysis was performed to extract factors from the fourteen financial indicators using IBM SPSS Statistic 26. The data was obtained from SINA NET FINANCE [3].

Table 1: Shows fourteen financial indicators

	Financial indicators
Profitability	Net profit margin on sales (X1) Return on total assets (X2) Return on net assets (X3) Profit margin on net assets (X4) Earnings per share (X5)
Growth capacity	Total assets growth rate (X6) Net assets growth rate (X7) Net profit growth rate (X8)
Operational capacity	Equity turnover (X9) Total assets turnover (X10)
Solvency	Current ratio (X11) Quick ratio (X12) Equity ratio (X13) Debt to asset ratio (X14)

III. Statistical analysis and Results

Feasibility test

The first step in factor analysis is to check the relationship among the fourteen financial indicators [4]. The correlation between the chosen variables was tested through Bartlett's sphericity test and Kaiser-Mayer-Olkin test, as presented in table 2. If KMO is above 0.5 and sig. is less than 0.01, it is proper to perform factor analysis [5]. It can be seen from table 2 that $KMO = 0.535 > 0.5$ and $sig. < 0.01$, which means the variables were significantly correlated to each other. Thus, it is proper to use factor analysis.

Table 2: Shows Bartlett's sphericity test and Kaiser-Mayer-Olkin test

Test		Value
Kaiser-Mayer-Olkin test (KMO)		.535
Bartlett's sphericity test	Approx.Chi-square	297.701
	df	91
	Sig.	.000

Factor extraction

We extracted factors from fourteen considered financial indicators under the principal component method. Then we chose the factors with an eigenvalue greater than 1. As can be seen in table 3, there were three factors with an eigenvalue higher than 1, which contained 82.035% variation of the data. As shown in figure 1, the scree plot flattens out after component number 3. Thus, we chose the first three factors to evaluate financial performance.

Table 3: Variation of extracted components

	Initial eigenvalues			Variation of extracted factors		
Factor	Total	% of variation	%cumulative	total	%of variation	%cumulative
1	7.305	52.180	52.180	7.305	52.180	52.180
2	2.607	18.623	70.803	2.607	18.623	70.803
3	1.573	11.232	82.035	1.573	11.232	82.035
4	.923	6.590	88.626			
5	.648	4.631	93.257			
6	.411	2.936	96.193			
7	.319	2.281	98.473			
8	.131	.935	99.408			
9	.055	.395	99.803			
10	.019	.138	99.942			
11	.006	.041	99.982			
12	.001	.010	99.992			
13	.001	.006	99.998			
14	.000	.002	100.000			

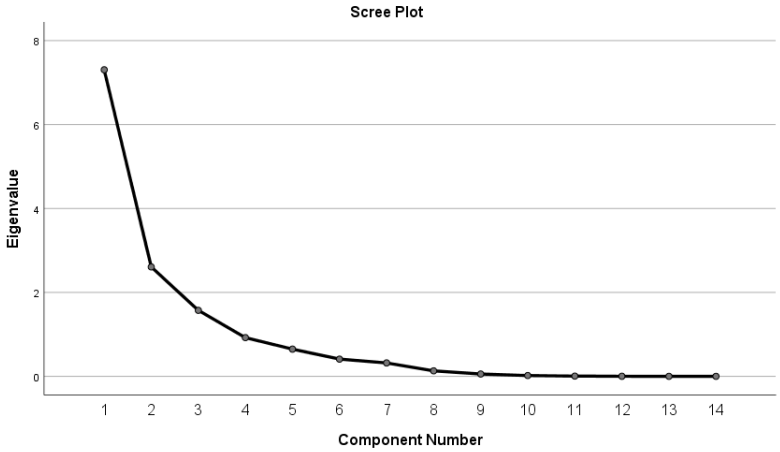

Figure 1: Scree plot

Factor rotation

We applied factor rotation under the varimax method to elaborate on the relationship between the three factors and the fourteen initial financial indicators [6]. Following this, we obtained the factor loading matrix, as

presented in table 4. Table 5 shows that the variation of each rotated factor is slightly different from the original one, but the cumulative variation is still the same.

To easily interpret the results, we explained each rotated factor by the fourteen initial financial indicators with factor loading greater than 0.58. As shown in table 4, the financial indicators with a strong correlation to the first rotated factor are net profit margin on sales, return on total assets, return on net assets, the profit margin on net assets, earnings per share, current ratio, quick ratio, equity ratio, and debt to asset ratio. Thus, the first rotated factor represented profitability and solvency. The financial indicators with a strong correlation to the second rotated factor are total assets growth rate, net assets growth rate, and net profit growth rate. Thus, the second rotated factor represented growth capacity. The financial indicators with a strong correlation to the third rotated factor are equity turnover and total assets turnover. Thus, the third rotated factor represented operational capacity.

Table 4: Rotated component matrix

	Component		
	1	2	3
Net profit margin on sales	0.839	0.352	0.181
Return on total assets	0.828	-0.013	0.104
Return on net assets	0.805	-0.026	0.381
Profit margin on net assets	0.798	0.363	0.370
Earnings per share	0.741	0.383	0.432
Equity turnover	-0.057	0.031	0.977
Total assets turnover	0.233	0.051	0.905
Total assets growth rate	0.071	0.899	-0.145
Net assets growth rate	0.221	0.904	0.136
Net profit growth rate	0.487	0.583	0.226
Current ratio	0.764	0.388	-0.048
Quick ratio	0.698	0.515	-0.051
Equity ratio	-0.836	-0.217	0.384
Debt to asset ratio	-0.731	-0.168	0.464

Table 5: Variation of extracted and rotated components

Factor	Total	% of variation	%cumulative
1	5.878	41.985	41.985
2	2.864	20.456	62.441
3	2.743	19.594	82.035

Estimation of factor scores

After explaining the three retained factors, we applied the regression method to estimate the factor scores of each observation in statistical software IBM SPSS Statistic 26, as presented in table 6.

Table 6: Values of the factor matrix

	Components		
Initial variables	1	2	3
Net profit margin on sales	.136	.007	.030
Return on total assets	.212	-.180	.006
Return on net assets	.198	-.185	.111
Profit margin on net assets	.116	.019	.102
Earnings per share	.094	.041	.128
Equity turnover	-.061	.016	.370
Total assets turnover	.013	-.033	.331
Total assets growth rate	-.162	.456	-.068
Net assets growth rate	-.136	.424	.031
Net profit growth rate	-.004	.200	.058
Current ratio	.119	.045	-.054
Quick ratio	.076	.124	-.054
Equity ratio	-.187	.056	.181
Debt to asset ratio	-.173	.059	.207

Based on table 6, the three factors can be written as the following linear combination of the fourteen initial financial indicators:

$$F1 = 0.136X1 + 0.212X2 + 0.198X3 + 0.116X4 + 0.094X5 - 0.061X6 + 0.013X7 - 0.162X8 - 0.136X9 - 0.004X10 + 0.119X11 + 0.076X12 - 0.187X13 - 0.173X14$$

$$F2 = 0.007X1 - 0.18X2 - 0.185X3 + 0.019X4 + 0.041X5 + 0.016X6 - 0.033X7 + 0.456X8 + 0.424X9 + 0.2X10 + 0.045X11 + 0.124X12 + 0.056X13 + 0.059X14$$

$$F3 = 0.3X1 + 0.006X2 + 0.111X3 + 0.102X4 + 0.128X5 + 0.37X6 + 0.331X7 - 0.068X8 + 0.031X9 + 0.058X10 - 0.054X11 - 0.054X12 + 0.181X13 + 0.207X14$$

Following this, we can obtain factor scores for each observation. Then the integrated score was calculated by the weight of the variance of each rotated factor to the total cumulative variance of the three rotated factors:

$$F = (41.985F1 + 20.456F2 + 19.594F3)/82.035$$

As shown in table 7, we obtained factor scores using the formulas above. When the factor score is positive, the greater the value, the better the capability represented by the factor. When the factor score is negative, it suggests that the capability represented by the factor is comparatively weak. From table 8, we can see that from profitability and solvency factor F1, the top three are DMEGC, Kedali Industry, and Ganfeng Lithium Group. However, the factor score of Tianqi Lithium performs weakly on F1. From the growth capacity factor F2, the top three are EVE Energy, Inovance, and CATL. However, Do-Fluoride Chemicals performs weakly on F2. EVE Energy's score is much higher among them. It indicates that its capability of expanding the economic scale was strong in 2019. From operational capacity F3, the top three are Desay, Sunwoda, and BYD. However, Ganfeng Lithium Group performs weakly on F3. Desay's score is much higher among them. It indicates that it performed well in operation and management in 2019. From the integrated score, the top three are Desay, DMEGC, and EVE Energy. As presented in table 7, there were significant disparities among the three-factor scores of most companies. The results suggest that profitability, solvency, growth capacity, and operational capacity were poorly coordinated and balanced. Also, more than half of the companies had negative factor scores on growth capacity factor and operational capacity.

Table 7: Factor scores and integrated scores

Company	Stock symbol	F1	F2	F3	F
Desay	000049	0.06275	-0.12646	2.79727	0.66871
DMEGC	002056	1.62914	-0.37926	-0.47491	0.625781
EVE Energy	300014	-0.25164	2.75373	-0.17647	0.515724
CATL	300750	0.24192	0.82946	-0.07447	0.312859
Kedali Industry	002850	0.90461	-0.16687	-0.48520	0.305474
Inovance	300124	0.32144	1.22095	-0.69242	0.303576
BYD	002594	0.34875	-0.96551	0.68965	0.102454
Sunwoda	300207	-0.79795	0.38735	1.60943	0.072612
Great Power	300438	0.29176	-0.40403	-0.02673	0.042189
China Baoan Group	000009	0.30353	-0.47848	-0.06136	0.021376
Ganfeng Lithium Group	002460	0.51454	-0.26684	-0.82187	0.000495
Gotion High-Tech	002074	-0.25454	0.18457	-0.49524	-0.20254
Do-Fluoride Chemicals	002407	-0.10143	-1.23656	-0.29717	-0.43124
CITIC Guoan Group	000839	-0.21688	-0.79391	-0.68202	-0.47187
Tianqi Lithium	002466	-2.99600	-0.55813	-0.80847	-1.86561

Table 8: Factor score ranking

Company	Stock symbol	F1	F2	F3	F
Desay	000049	9	6	1	1
DMEGC	002056	1	9	9	2
EVE Energy	300014	12	1	7	3
CATL	300750	8	3	6	4
Kedali Industry	002850	2	7	10	5
Inovance	300124	5	2	13	6
BYD	002594	4	14	3	7
Sunwoda	300207	14	4	2	8
Great Power	300438	7	10	4	9
China Baoan Group	000009	6	11	5	10
Ganfeng Lithium Group	002460	3	8	15	11
Gotion High-Tech	002074	13	5	11	12
Do-Fluoride Chemicals	002407	10	15	8	13
CITIC Guoan Group	000839	11	13	12	14
Tianqi Lithium	002466	15	12	14	15

IV. Conclusion

In this paper, the factor analysis was utilized to analyze the financial performance of 15 listed companies in the renewable energy automobile industry in 2019. The proposed financial performance evaluation system extracted three common factors from fourteen financial indicators, which were selected based on profitability, solvency, growth capacity, and operational capacity.

The following problems were found in the analysis: (1) The overall financial performance is unsatisfactory. (2) Profitability, solvency, growth capacity, operational capacity, and other aspects are unevenly

developed. (3) Growth capacity and operational capacity need to be improved. Nowadays, as the market position of technology is gradually growing, and the future development of the renewable energy automobile industry is bound to solve these difficulties. Therefore, in response to the above problems, renewable energy automobile companies should comprehensively improve their business levels and should not be limited to one aspect, focusing on strengthening growth and operational capacities. They should suit their circumstances and objectives, and learn from the experience of successful companies, and continuously improve their technology. They should also positively respond to government incentive policies and promote the coordinated development of various financial performance indicators.

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