

Comprehensive Evaluation of Aviation Leasing Enterprises Based on Factor Analysis Method

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Abstract: The COVID-19 epidemic in 2020 has a significant impact on the air transport industry, and the air leasing enterprises have suffered serious losses as a result. Therefore, the establishment of a sound comprehensive evaluation system for air leasing enterprises plays a pivotal role. This paper evaluates the comprehensive strength of 12 domestic and foreign aviation leasing enterprises through factor analysis, selects two factors that affect the comprehensive strength and obtains the scores of various factors and comprehensive scores of sample companies, and finally objectively analyzes the factors that affect the comprehensive strength of domestic and foreign aviation leasing enterprises, and gives corresponding suggestions.

1. Introduction

With the rapid development of the economy, the civil aviation industry and the aircraft manufacturing industry ushered in a new golden period of development[1]. The operating profit of the whole industry in the past ten years has exceeded the sum of the previous four decades[2]. As a link between them, the aviation aircraft leasing industry is bound to gain new opportunities. Aircraft is an important resource for the development of aviation, and the development of aircraft leasing industry fully promotes the realization of the value of civil aviation, meets the realistic needs of the survival and development of civil aviation industry, and is the support for the survival and development of airlines. In recent years, due to the rapid development of the global air transport industry, the size of the world's air transport fleet is also expanding. More than 40% of the world's air transport fleet is owned or managed by various leasing forms[2][3]. In this context, the competition in the aviation leasing market is becoming more and more fierce, which puts forward higher requirements for the competitiveness of aviation leasing enterprises[4]. In order to enhance their competitiveness and maximize their value, aviation leasing companies need a set of scientific and complete comprehensive evaluation system to provide favorable support. Although many domestic and international aviation leasing enterprises have been ranked and evaluated by various standards, there are still some problems in the evaluation of aviation leasing enterprises, such as insufficient information disclosure, lack of comprehensive evaluation of financial performance evaluation, and

performance evaluation is only a form[5][6]. Therefore, it is necessary and of practical significance to make comprehensive evaluation for listed aviation leasing enterprises. Here, this paper plans to use factor analysis method and SPSS25.0 software to establish a two-level comprehensive evaluation system of aviation leasing enterprises for 12 enterprises and 6 evaluation indicators, analyze the evaluation results and put forward suggestions according to the results.

2. Research of Design

2.1 Selection of Samples

By checking the annual reports of aviation leasing enterprises, this study selects the relevant data of 15 aviation leasing companies in 2020, and excludes some unlisted companies with imperfect information. Finally, 12 domestic and foreign listed aviation leasing companies are selected. The 12 companies are: AerCap, Air Lease Corporation, SMBC Aviation Capital, DAE Capital, Aviation Capital Group, Aircastle Limited, Nordic Aviation Capital, Avolon, BOC Aviation, CDB Aviation, China Aircraft Leasing and BOHAI Leasing. Then, this paper uses SPSS25.0 for factor analysis to evaluate the selected sample companies.

2.2 Determination method

Factor analysis is a statistical method that uses a few potential and unobservable variables to describe the covariance relationship among many variables, and uses the idea of dimension reduction to transform multiple variables into a few unrelated comprehensive variables, so as to simplify the research. The reason why this study chose factor analysis method is that it has the characteristics of objectivity and operability[7].

2.3 Selecting Indicators

As an airline leasing company, the company size development and financial status are the indicators to assess whether an airline leasing company is growing. Based on the actual situation, this paper selects the following six indicators from two aspects of development factor and operation factor: number of aircrafts X_1 , number of cooperative airlines X_2 , remaining lease period of the aircraft X_3 , total revenue X_4 , total assets X_5 and cash flow X_6 .

3. The Empirical Analysis

3.1 Applicability Test

According to the sample correlation between KMO and Bartlett's spherical test, when the sample moderate measured value in KMO is greater than 0.5, and the significance probability of Bartlett's test is less than 0.01, it indicates that factor analysis is suitable[8]. In this study, the data of 12 standardized listed aviation leasing companies were imported into SPSS25.0. Its KMO value is 0.698 >0.5, and Bartlett significance level was 0.000 <0.01, indicating large correlation between sample data. The results are shown in TABLE 1.

Table 1. Applicability Test Numerical Results

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.698
Bartlett's test of sphericity	Approx. Chi-Square	73.626
	df	15
	Sig.	0.000

3.2 Communalities

In terms of extraction degree, the extraction degree of aircraft numbers, cooperative airline numbers and remaining lease period was 0.913 0.862 0.633, respectively. Total revenue, total assets and cash flow extraction were 0.961, 0.990 and 0.992 respectively. In other words, the extraction degrees of all variables are greater than 0.5, and the extraction degrees of most indicators are greater than 0.8, indicating that the extracted index components can reflect most of the original index information, and the extraction degree is relatively high. The communalities are shown in TABLE 2.

Table 2. Communalities For Indicators

Indicators	Communalities	
	<i>Initial</i>	<i>Extraction</i>
Number of aircrafts	1.000	0.913
Number of cooperative airlines	1.000	0.862
Remaining lease period of the aircraft	1.000	0.633
Total revenue	1.000	0.961
Total assets	1.000	0.990
Cash flow	1.000	0.992

3.3 Extract Common Factors

SPSS25.0 was used to analyze the dimension reduction of the comprehensive data of 12 aviation leasing companies and then the method of extracting the common factor with the feature root greater than 1 was adopted. Finally, two common factors with the initial eigenvalues of two components greater than 1 were obtained. According to the results, the initial eigenvalue data obtained in the total variance explained table are shown in Table 3.

Table 3. Total Variance Explained (1)

Component	Initial Eigenvalues		
	<i>Total</i>	<i>% of Variance</i>	<i>Cumulative %</i>
1	4.111	68.524	68.524
2	1.240	20.662	89.186
3	0.466	7.766	96.953
4	0.140	2.330	99.283
5	0.031	0.522	99.805
6	0.012	0.195	100.000

According to the total variance explained table, the rotation sums of squares loading is shown in Table 4.

Table 4. Total Variance Explained (2)

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.341	55.683	55.683
2	2.010	33.504	89.186

As shown in the above table, the characteristic root of the first common factor is 3.341, and the contribution rate is 55.684%. The second common factor characteristic root was 2.010, and the contribution rate was 33.503%. The cumulative contribution rate of the two common factors was 89.186%, which is more than 80%, indicating a high contribution rate. Therefore, the common factors extracted in this paper can be analyzed and discussed.

3.4 Factor Load Matrix Analyzed

In order to simplify the structure of factor loading matrix, the maximum variance method was used in this study to perform orthogonal rotation of factor loading matrix. The results of rotation component matrix are shown in the table 5 below:

Table 5. Rotated Component Matrix^a

Indicators	Component	
	1	2
The total number of the plane	0.955	0.039
Number of cooperative airlines	0.916	0.153
Remaining lease period of the aircraft	0.767	0.212
Total revenue	0.800	0.566
Total assets	0.602	0.792
Cash flow	0.002	0.996

As shown in the above table, after the rotating component matrix is obtained in this study, it can be found that the total number of aircraft X_1 , cooperative airline X_2 and remaining lease X_3 have a large load on the common factor F_1 . These indicators reflect the development of the company itself, so the common factor F_1 is named as the development factor in this study. The total revenue F_4 , total assets F_5 and cash flow F_6 have a large load on the common factor F_2 , which reflects the company's own operating conditions. In this study, the common factor F_2 is defined as the operating factor.

3.5 Factor score and comprehensive score

The linear expression of each common factor about each indicator was obtained by regression method, and the score of the common factor corresponding to each indicator was calculated. The expressions of two principal components were obtained according to the component score coefficient matrix in the following table 6.

Table 6. Component Score Coefficient Matrix

Indicators	Component	
	1	2
The total number of the plane	0.367	-0.212
Number of cooperative airlines	0.323	-0.128
Remaining lease period of the aircraft	0.250	-0.053
Total revenue	0.174	0.171
Total assets	0.039	0.369
Cash flow	-0.248	0.652

Calculating formula of each component is obtained according to the above table:

Expression formula of common factor F₁:

$$F_1 = 0.367 X_1 + 0.323 X_2 + 0.250 X_3 + 0.174 X_4 + 0.039 X_5 - 0.246 X_6 \quad (1)$$

Expression formula of common factor F₂:

$$F_2 = -0.212 X_1 - 0.128 X_2 - 0.053 X_3 + 0.171 X_4 + 0.369 X_5 + 0.652 X_6 \quad (2)$$

Further, according to the contribution rate and cumulative contribution rate of each factor in the total variance explained table, the comprehensive scoring formula can be obtained:

$$F = (55.683 * F_1 + 33.503 * F_2) / 89.186 \quad (3)$$

The standardized original data were substituted into the two factor scoring functions and the total evaluation function to obtain the scores of each factor. The comprehensive scores and ranking are as follow table 7:

Table 7. Table of Scoring and Ranking Results

Airlines	Scores (Ranking)		
	<i>F₁ score (ranking)</i>	<i>F₂ score (ranking)</i>	<i>F composite score (ranking)</i>
AerCap	2.68 (1)	-0.19 (6)	1.60 (1)
Bohai Leasing	0.86 (2)	0.59 (3)	0.76 (2)
Avolon	0.26 (3)	0.90 (2)	0.50 (3)
CDB Aviation	-0.82 (10)	2.57 (1)	0.45 (4)
BOC Aviation	0.14 (4)	-0.01(5)	0.08 (5)
Air Lease Corporation	-0.21(7)	0.33(4)	0.00(6)
SMBC Aviation Capital	0.12 (5)	-0.87 (11)	-0.25 (7)
DAE Capital	-0.19 (6)	-0.53 (7)	-0.32 (8)
Aviation Capital Group	-0.45 (8)	-0.63(9)	-0.52(9)
Nordic Aviation Capital	-0.56 (9)	-0.88 (12)	-0.68 (10)
Aircastle Limited	-0.83 (11)	-0.74 (10)	-0.80 (11)
China Aircraft Leasing	-1.00 (12)	-0.55 (8)	-0.83 (12)

4. Analysis of Result and Relevant Suggestions

4.1 Result analysis

1) *From the perspective of comprehensive ranking:* The combined score F of 12 sample companies was between -0.83 and 1.60. The top five aviation leasing companies are AerCap, Bohai Leasing, Avolon, CDB Aviation and BOC Aviation. DAE Capital, Aviation Capital Group, Nordic Aviation Capital, Aircastle Limited and China Aircraft Leasing were at the bottom of the list. As can be seen from the numbers, AerCap's overall score is the first and more than twice that of the second place Bohai Leasing. It can be seen that Avolon, as a wholly-owned subsidiary of Bohai Leasing, has a strong strength. China Aircraft Leasing ranked the last, visible in the comprehensive strength is weaker than the above enterprises.

2) *From the perspective of development factor F₁:* The proportion of development factor F₁ was 55.683%. Among the 12 companies, AerCap ranked first with a score of 2.68, which is 3.12 times that of Bohai Leasing. Moreover, the F₁ factor of more than half of the aviation leasing companies is less than 0. It can be seen that AerCap has a strong development factor, far exceeding other

aviation leasing companies. Bohai Leasing and its subsidiary Avolon are still ranked second and third in the development factor analysis. China Aircraft Leasing still ranked last with -1.00. It can be seen that the overall industry development level is uneven, the gap is large, each company still has a large room for improvement.

3) *From the perspective of operating factor F₂*: Operating factors accounted for 33.503%. CDB Aviation ranked first with a score of 2.57, 1.67 points ahead of Avolon and 3.45 points ahead of Nordic Aviation Capital. AerCap ranked sixth with a -0.19 operating factor score. Nordic Aviation Capital ranked last with a score of -0.88. As can be seen in general, although the overall industry level is still uneven, the ranking order differs greatly from that of F₁, which also indicates that the enterprises with a good overall ranking do not excel in both F₁ and F₂ factors.

To sum up, this paper concludes that the development capacity and operation capacity of some listed aviation leasing enterprises are uneven in 2020. Although AerCap, Bohai Leasing and Avolon rank in the top three overall, and few companies can take into account the development of the two capabilities. This paper argues that enterprises should keep their advantages and make up for their weaknesses so as to enhance their comprehensive strength.

4.2 Suggestions

1) *Implement enterprise merger and acquisition to obtain synergies effect*: Large aviation leasing companies should fully understand their advantages and carry out mergers and acquisitions, acquire some small and medium-sized enterprises, improve the degree of industry concentration, reduce their own operational risks, so as to achieve synergistic effects, economies of scale, and resource complementarity. Mergers and acquisitions can also achieve management synergies, thus saving management costs and making full use of excess management resources. The cost of aviation leasing enterprises is relatively high[9]. If they can make good use of the production and sales chain relationship between upstream and downstream enterprises and make concerted progress, the benefits can be maximized. At the same time, economies of scale can also bring great benefits. In the early stage, Bohai Leasing acquired Avolon[10][11], and AerCap acquired GECAS in 2020[12]. Both of them have strengthened their own strength through mergers and acquisitions, and become the companies with strong comprehensive strength among aviation leasing enterprises.

2) *Increase investment in research and development, improve their core competitiveness*: Listed aviation leasing companies should vigorously invest in research and development, generally speaking, research and development investment and profit are proportional to change. The increase in research and development investment can improve the scientific and technological value of products, so as to stand out among similar products, which has a strong guiding role in enhancing the sustainable profitability and core competitiveness of enterprises. In addition, research and development expenses can be deducted in the tax law, which can reduce the tax burden of enterprises.

5. Conclusion

In this paper, factor analysis is used to evaluate the comprehensive strength of 12 domestic and foreign aviation leasing enterprises. Through the model construction and scoring of development factor and operation factor, it is concluded that there is a large gap between the comprehensive strength of domestic and foreign aviation leasing enterprises, and there is a lack of overall consideration, and suggestions are put forward. The development prospect of aviation leasing listed companies is very broad, all enterprises should take into account overall consideration, make up the short board, and strive to improve their competitiveness to achieve the maximum benefit.

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