

Research on Financing Efficiency of Small and Medium-Sized Logistics Enterprises New Third Board Market

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Abstract: In order to analyze the financing efficiency of small and medium-sized logistics enterprises in China, this paper is based on the financial data disclosed by 19 small and medium-sized logistics enterprises listed on the New Third Board, and uses the DEA-BCC model to analyze the financing efficiency from 2016 to 2020, it can be seen that: 1) the financing efficiency of small and medium-sized logistics enterprises in China has been on the rise, but it has not reached the ideal level; 2) the level of pure technical efficiency is higher than the scale efficiency; 3) the mold technology limits the improvement of financing efficiency; 4) From the perspective of different industries, The freight forwarding industry has the highest financing efficiency.

Keywords: New Third Board, Financing Efficiency, DEA, Small and Medium-sized Logistics Enterprises.

1. Introduction

Logistics enterprises as a basic industry, in the policy, economy, society and technology and other fields have a good living environment and development opportunities, logistics enterprises in the future development is full of opportunities, small and medium-sized logistics enterprises occupy the vast majority of the logistics industry, "economic circulation" policy requires logistics enterprises to upgrade, small and medium-sized logistics enterprises need a lot of liquidity support at each stage of development. However, due to their own financial transparency, asymmetric information between banks and enterprises, and few collateral assets, small and medium-sized logistics enterprises have low financing capabilities and financing efficiency. One of the purposes of financial development is to improve the efficiency of investment and financing in the development of the real economy, so as to promote the development of the real economy. The financing efficiency of small and medium-sized logistics enterprises refers to the allocation efficiency and use efficiency of funds by small and medium-sized logistics enterprises, that is, the study of the degree to which small and medium-sized logistics enterprises obtain the greatest profit by investing the least cost. Strengthening the research on the financing efficiency of small and medium-sized logistics enterprises can improve the operation quality of small and medium-sized logistics enterprises, and also meet the current national requirements for the development of logistics enterprises. This paper studies the operating conditions and performance of 19 small and medium-sized logistics enterprises listed on the New Third Board by measuring the financing efficiency of 19 small and medium-sized logistics enterprises listed on the New Third Board, and then helps small and medium-sized logistics enterprises to make better financing decisions in the future.

2. Literature Review

Due to the different property organization systems and property rights systems in China, there are few studies on the financing efficiency of enterprises [1]. The application of the concept of financing efficiency in China stems from Lan

Gengyun's research on the reform of the rural financial system, and she proposes to shift the focus of the reform of the rural financial system from the expansion of financing scale to the improvement of financing efficiency [2].

In terms of research on small and medium-sized enterprises, Zhu Jianjun and Wei Kaiwen used fuzzy comprehensive evaluation methods to conclude that the financing efficiency of endogenous financing is higher than that of external financing[3][4]; Liao Yan et al. found that the listing on the New Third Board did not play a significant positive role in the financing efficiency of SMEs through setting up a control group[5]; Wei Hua and others specifically studied the financing efficiency of regional aggregate notes and found that there are obvious differences in financing efficiency in regions[6]; Wu Yangfen et al. found that there were obvious differences in the financing efficiency of different industries through the Malmquist index method[7]. In the study of logistics enterprises, Gong Xingguo found that the financing efficiency of different industries in listed logistics enterprises was different[8]; Zhou Lei and Wang Wenyin found that scale efficiency hindered the development of financing efficiency of listed logistics enterprises[9][10]; Huang Yongfu came to different conclusions, he proved that scale efficiency promotes the growth of financing efficiency of listed logistics enterprises [11].

It can be found that the research on logistics enterprises is aimed at listed enterprises, and the application of the gray correlation degree analysis method and Yang Yi's application of the DEA model have concluded that the financing efficiency of large enterprises is higher than that of small and medium-sized enterprises [12][13], therefore, the conclusions of previous studies cannot explain the financing of small and medium-sized logistics enterprises, so the financing efficiency of small and medium-sized logistics enterprises needs to be further studied. This study strictly screens the small and medium-sized logistics enterprises listed on the New Third Board, measures the financing efficiency through the data envelopment analysis method, and then analyzes the financing status of small and medium-sized logistics enterprises, which provides a theoretical basis for expanding the financing channels of small and medium-sized logistics enterprises in reality, improving the financing efficiency of

small and medium-sized logistics enterprises and building a harmonious logistics financial ecology.

3. Research Methods and Study Design

3.1. Financing Efficiency Evaluation Model: DEA-BCC Model

Since the scale efficiency of small and medium-sized logistics enterprises will change with the changes in the external environment such as industry environment and national policies, it is difficult to increase the proportion of input and output in the actual situation, and considering it comprehensively, the DEA-BCC model is selected in this paper.

There are n decision units, m input elements, and s output elements. The BCC model used in this article is:

$$\min[\theta - \varepsilon(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+)] \quad (1)$$

$$\text{s.t.} \begin{cases} \sum_{j=1}^n \lambda_j x_{ij} + s_i^- = \theta x_{i0}, i=1,2,3,\dots, m \\ \sum_{j=1}^n \lambda_j x_{rj} - s_r^+ = \theta y_{r0}, r=1,2,3,\dots, s \\ \sum_{j=1}^n \lambda_j = 1 \\ s^-, s^+, \lambda_j, \theta \geq 0, j=1,2,\dots, n \end{cases} \quad (2)$$

$x_{ij} = (x_{1j}, x_{2j}, \dots, x_{mj})^T$ for the set of input factors, $y_{rj} = (y_{1j}, y_{2j}, \dots, y_{sj})^T$ is the set of output factors, wherein x_{ij} represents the i th index of the j th decision unit, y_{rj} represents the r index of the j decision unit, and $x_{mj}, y_{sj} > 0$; θ is the target value of the linear programming, that is, the level of pure technical efficiency, the higher the value indicates the higher the financing efficiency; the ε is infinitesimal; s_i^-, s_i^+ is the relaxation variable; λ_j is the proportion of the j decision unit.

3.2. Indicator Selection and Correlation Analysis

When using DEA technology to measure financing efficiency, reasonable input-output indicators will be measured to obtain more time-based measurement results. In the selection of indicators, there are three types of data, the smaller the value of the better indicators, the smaller the absolute value of the better indicators, the larger the value of the better indicators, the first two can be used as input indicators, the latter can be used as output indicators [14]. In this paper, after referring to the relevance of the basic and indicators of the predecessor research and the availability of data, three indicators are selected as input indicators and three indicators are selected as output indicators.

3.2.1. Input Metrics

Total assets (X_1), reflecting the asset size of small and medium-sized logistics enterprises. In the input-output indicator system, the smaller the better, which in the study in this paper is equal to the value of the "total assets" item in the balance sheet.

Operating cost (X_2), is the cost of small and medium-sized logistics enterprises in production and operation, covering employee wages, logistics facilities and equipment costs, daily operating costs, outsourcing costs, etc., directly related to operating income, determine the size of the company's

profits, reflect the ability of enterprise operations. The smaller the better, which in the study in this article is equal to the value of the "Cost of Main Business" item in the income statement.

Asset-liability ratio (X_3), also known as debt-to-business ratio, asset-liability ratio = total liabilities and total assets. This indicator reflects the solvency and capital structure of small and medium-sized logistics enterprises. The asset-liability ratio is too high or too low can not indicate that the capital structure of the enterprise is reasonable, and the optimal asset-liability ratio value of different industries is different, in the study of this paper, the indicator takes the absolute value of the difference between the actual value of the current asset-liability ratio and the industry average.

3.2.2. Output Indicators

The return on net assets (Y_1), also known as the return on net assets. This indicator reflects the efficiency of small and medium-sized logistics enterprises in the use of their own funds.

The total asset turnover ratio (Y_2). This indicator can reflect the efficiency of small and medium-sized logistics enterprises in using the raised capital.

The growth rate of operating income (Y_3). This indicator indicates the revenue of small and medium-sized logistics enterprises, reflecting the business situation and development ability of enterprises.

3.2.3. Correlation Analysis of Indicators

When using the DEA model, we have to do the Person correlation test on input and output indicators to test the positive and negative correlation between input and output indicators, as shown in Table 1, there is a positive correlation between all indicators.

Table 1. Correlation test results

	Total Assets	Operating Costs	Gearing ratio
Total Asset Margin	0.0811	0.0785	0.0742
Total assets turnover ratio	0.0228	0.0657	0.1137
Operating income growth	0.5277	0.9006	0.2082

3.3. Data Selection and Pre-processing

3.3.1. Data Selection

In this paper, 19 small and medium-sized logistics enterprises are selected as sample enterprises. As of December 31, 2020, there were 141 logistics enterprises listed on the New Third Board. In order to ensure the reliability, continuity and stability of the sample data, the sample data were selected as follows: first, by referring to the "Statistical Classification of Large, Small, Medium and Micro Enterprises (2017)" issued by the National Bureau of Statistics in 2017, the enterprises whose main business is "transportation, postal service and storage" in the industry classification of the New Third Listed Enterprises were excluded. Secondly, the enterprises with business income or employees exceeding the prescribed range before listing were excluded; thirdly, ST and ST* enterprises with losses for two consecutive years were excluded, and suspended enterprises were excluded; fourthly, enterprises that had not raised actual financing within four years after listing and enterprises with incomplete data disclosure were excluded. Finally, a total of 570 data for 2016-2020 from 19 small and medium-sized

logistics enterprises listed before January 1, 2016 and with complete financial data within five years after listing were selected as research data. The financial data were obtained from the data disclosed by the National Small and Medium Enterprises Stock Transfer System and the China Business Industry Research Institute.

According to the statistical rule of thumb, the number of decision-making units should be more than twice that of input and output indicators. The relationship between the number of input-output indicators and the sample of small and medium-sized logistics enterprises in this paper meets this requirement. Therefore, the DEA model can be used for calculation.

3.3.2. Data Dimensionless Processing

In the DEA model, there is a non-negativity requirement for the data, and the indicators selected in this paper differ in value and have negative data, so the values of the indicators need to be dimensionless to ensure the scientific nature of the model in the following way.

$$x_{ij}^* = 0.1 + 0.9 \times \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \quad (3)$$

x_{ij} denotes the raw data of the j th indicator corresponding to the i th decision unit, the x_{min} denotes the minimum value of the j th indicator corresponding to all decision units, and x_{max} denotes the maximum value of the j th indicator corresponding to all decision units, and x_{ij}^* denotes x_{ij} denotes the standardized value after dimensionless, and the variation interval is $[0, 1]$.

3.4. Measurement and Analysis of Static Efficiency of Financing for Small and Medium-sized Logistics Enterprises

The output-oriented DEAP 2.1 software was used to calculate the financing efficiency of 19 small and medium-sized logistics enterprises separately for the period 2016-2020. The changes in technical efficiency, pure technical efficiency, scale efficiency and scale efficiency of the firms over the 5-year period were measured.

3.4.1. From An Industry-wide Perspective.

Table 2. Statistics of financing efficiency of small and medium-sized logistics companies

Year		2016	2017	2018	2019	2020	Average
Technical efficiency	Average value	0.793	0.834	0.835	0.894	0.817	0.835
	Number of valid	6	6	10	11	11	3
Pure technical efficiency	Average value	0.874	0.925	0.946	0.95	0.895	0.918
	Number of valid	8	9	12	12	11	4
Scale efficiency	Average value	0.899	0.899	0.873	0.934	0.892	0.899
	Number of valid	6	7	10	11	11	3
Scale efficiency changes	Incremental	2	1	1	1	0	-
	Unchanged	6	7	10	11	11	3
	Decreasing	11	11	8	7	8	2

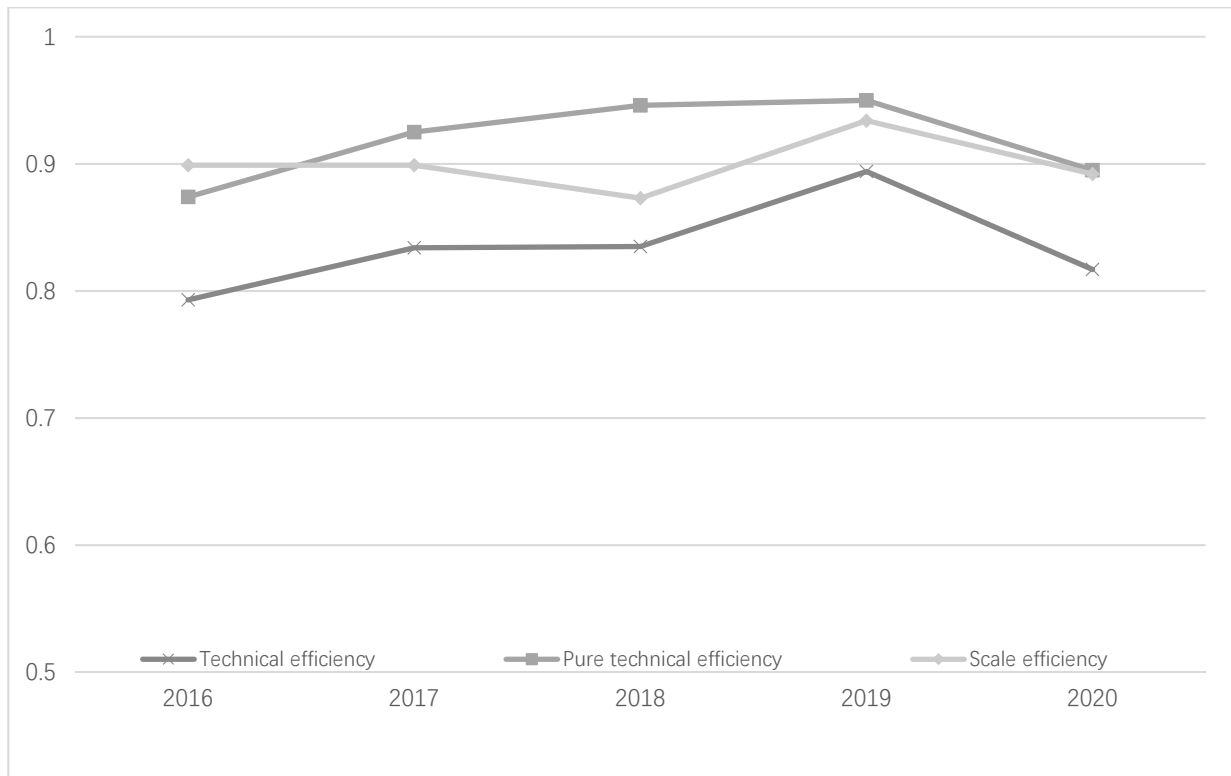


Figure 1. Time evolution of static efficiency of industry-wide financing for small and medium-sized logistics enterprises

Analysis of Table 2 shows that according to the BCC model, DEA is effective when technical efficiency is equal to 1, i.e., resources can be fully utilized, and DEA is ineffective when technical efficiency is in the range of 0-1, and resources are not fully utilized. 2016-2020, the percentage of effective technical efficiency is 31.58%, 31.58%, 52.63%, 57.89%, 57.89%, respectively, only 15.79% of the enterprises have a reasonable financing input-output structure in the four years, i.e., the fixed inputs maximize the output, and the overall financing efficiency is low.

Analyzing the trend of Table 2 and Figure 1, it is found that the average technical efficiency of small and medium-sized logistics enterprises in 2016-2020 is 0.835, currently, the overall financing efficiency of small and medium-sized logistics enterprises in China has not reached the ideal state, but the overall technical efficiency of small and medium-sized logistics enterprises shows an upward trend, and the number of enterprises with constant scale payoff gradually increases, which indicates that the overall financing efficiency of small and medium-sized logistics enterprises in China is developing to the good. On the one hand, it is related to the rapid development of logistics industry in recent years, and on the other hand, it also indicates that the financial environment pays more attention to the innovative services in financing. From the results of efficiency decomposition, the trends of technical efficiency and scale efficiency are roughly the same, and the mean values of pure technical efficiency and scale efficiency are 0.918 and 0.899 respectively, and the pure technical efficiency and scale efficiency curves show an upward trend in general, and the pure technical efficiency curve is above the scale efficiency curve, which can indicate to a certain extent that the improvement of financing efficiency of small and medium-sized logistics enterprises in China is mainly achieved by improving the pure The

financing relies on financial innovation and enterprise management to pull, and is more constrained by the scale efficiency of enterprises.

Both 2018 and 2020 have seen a decline in the efficiency of corporate financing, respectively. The main reason for the decline in technical efficiency in 2018 is the decrease in financing scale, and the trade war between the US and China that started in early 2018 has had a huge impact on the global supply chain and China's light industry, etc., which has affected logistics enterprises as important players in the supply chain and serving light industrial goods. The decline in pure technical efficiency and scale efficiency together led to the reduction in financing efficiency of small and medium-sized logistics enterprises in 2020, which was due to the transient shutdown of the logistics industry and other industries due to the prevention and control of the new crown pneumonia epidemic in early 2020, followed by the logistics industry as the lifeblood of the economic cycle taking the lead in resuming work and production, and the state has also introduced a number of policies on reducing logistics costs and payment guarantees for SMEs to promote The rapid recovery of small and medium-sized logistics enterprises, support for SME financing and loans, but there was still a brief decline in financing efficiency, in line with the actual situation.

3.4.2. By Industry Classification

The existing 19 small and medium-sized logistics enterprises can be classified according to industry classification into three kinds of road cargo transportation, cargo transportation agency and warehousing industry, and the financing situation of each industry classification is shown in Table 3.

Table 3. Statistics of financing efficiency of small and medium-sized logistics enterprises by industry.

Industry	Year	Technical efficiency		Pure technical efficiency		Scale efficiency	
		Average value	Percentage of	Average value	Percentage of	Average value	Percentage of
Road cargo transport industry	2016	0.802	25.0%	0.890	25.0%	0.889	25.0%
	2017	0.770	12.5%	0.853	25.0%	0.899	25.0%
	2018	0.747	25.0%	0.898	37.5%	0.817	25.0%
	2019	0.797	37.5%	0.913	50.0%	0.860	37.5%
	2020	0.825	62.5%	0.902	62.5%	0.900	62.5%
	Average	0.788	-	0.891	-	0.873	-
Freight forwarding industry	2016	0.810	50.0%	0.861	62.5%	0.934	50.0%
	2017	0.952	62.5%	0.974	75.0%	0.976	62.5%
	2018	0.954	87.5%	0.977	87.5%	0.973	87.5%
	2019	0.952	62.5%	0.967	62.5%	0.984	62.5%
	2020	0.890	62.5%	0.931	62.5%	0.945	62.5%
	Average	0.912	-	0.942	-	0.962	-
Storage Industry	2016	0.724	0.0%	0.866	33.3%	0.837	0.0%
	2017	0.690	0.0%	0.988	33.3%	0.697	0.0%
	2018	0.753	66.7%	0.994	66.7%	0.756	33.3%
	2019	1.000	100.0%	1.000	100.0%	1.00	100.0%
	2020	0.601	33.3%	0.781	33.3%	0.734	33.3%
	Average	0.754	-	0.926	-	0.805	-

Analyzing Table 3, from the industry classification, the three classifications of the logistics industry have the highest financing efficiency in the freight forwarding industry, with a technical efficiency average of 0.912. The technical efficiency levels of the road freight transport industry and the warehousing industry are lower than the average technical efficiency level of the whole industry, with technical

efficiency averages of 0.788 and 0.754, respectively, which are limited by the sample size and the extreme values of The variation is more volatile.

The technical efficiency of the road cargo transport industry shows a trend of first decreasing and then increasing, unlike the whole industry, the technical efficiency in 2020 has undergone an upward change compared to 2019, with an

increase in scale efficiency and a decrease in pure technical efficiency, which is due to an increase in the number of interregional material transfers and an increase in transport volume in 2020, resulting in an increase in financing efficiency.

3.4.3. From An Individual Company Perspective

Tianxingjian, Mingshuo, and Yitian Logistics maintain effective technical efficiency for five consecutive years from 2016 to 2020, and the related slack variables are zero, and the inputs and outputs reach optimality and are in a state of constant payoffs to scale. Chase Logistics and Nordic Logistics are in a decreasing scale payoff for five consecutive years from 2016-2020, and the enterprises are in a state where the value added of inputs is greater than the value added of outputs for a long time, indicating that these enterprises do not pay attention to the reasonable allocation and use of capital while pursuing the expansion of enterprise production scale. Eight enterprises, namely, Yudu, Chase Logistics, Nordic Logistics, Jindal Bonded, Zongxie Port Service, Tongyi Logistics, Houyi Junjie and Jieshi Tong, all experienced a decrease in technical efficiency in 2020, while the remaining enterprises maintained growth or unchanged technical efficiency.

Goldbach and Houyi Junjie in 2016, Allsun Logistics, Yudu and Jieshitong in 2017, Houyi Junjie and Xintuo Logistics in 2018, and Kaidongyuan in 2019 all showed a pure technical efficiency of 1, but an ineffective technical efficiency, which is the reason why financing efficiency is limited by the size of financing, and is consistent with the findings in the industry-wide analysis.

4. Conclusions and Recommendations

This paper uses the financial data of the small and medium-sized logistics enterprises listed on the New Third Board to analyze the financing efficiency from 2016 to 2020. It can be seen that the financing efficiency of small and medium-sized logistics enterprises in my country has not reached an ideal state. Before 2020, it is on an upward trend and is affected by the industry environment. The financing efficiency is affected by both technical efficiency and scale efficiency. Among them, scale efficiency is the most important factor restricting the improvement of financing efficiency of small and medium-sized logistics enterprises in my country; In terms of different industries, the financing efficiency of the freight forwarding industry is higher than that of the warehousing industry and the freight forwarding industry. The transportation industry; the financing difference between individuals of small and medium-sized logistics enterprises is relatively large.

Based on this, the following countermeasures and suggestions are put forward to promote the financing efficiency of small and medium-sized logistics enterprises in my country: From the perspective of enterprises themselves, small and medium-sized logistics enterprises should establish an appropriate financing scale to avoid blind investment. The

rational allocation of funds, the formulation of the internal financial system of the enterprise and the development of financing innovation; from the national level, it is necessary to actively improve the financing environment of small and medium-sized enterprises, expand the financing platform, and increase tax and financial incentives.

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