ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

Research on Financing Efficiency of NEEQ Based on DEA Model

Chenxi Liu

Guangxi University, Guangxi 530000, China
843437926@qq.com

Abstract: *This paper firstly conducts practical research on Chinese NEEQ (National Equities Exchange and Quotations), evaluates the development status of NEEQ by referring to theoretical literature, and conducts academic research on related existing problems according to the status quo. On this basis, some NEEQ companies are selected as the empirical research orientation, and the financing efficiency of target companies is studied based on the DEA model. The study results found that NEEQ has problems such as low pure technical efficiency and a decline in total factor productivity.*

Keywords: *NEEQ(National Equities Exchange and Quotations); Financing efficiency; Data envelopment analysis; Empirical analysis*

1. Introduction

At present, Chinese small and medium-sized enterprises are the new force of national economic and social development, an essential foundation for building a modern economic system and promoting high-quality economic development, essential support for expanding employment and improving people's livelihood, and an essential birthplace for entrepreneurship. Doing an excellent job in SMEs is of great significance to stabilizing employment, finance, investment, foreign investment, foreign trade, and expectations and enhancing the economy's long-term competitiveness.

However, there are many problems for small and medium-sized enterprises that play an essential role in the development process of China. The most major problem is that the financing of small and medium-sized enterprises is difficult and expensive.

Therefore, it has become a very important topic to study the development status and existing problems of the NEEQ market and evaluate and improve the financing efficiency of the current NEEQ companies.

2. An Empirical Research on the Financing Efficiency of NEEQ Based on DEA Model

2.1 Data Collection and Indicator Selection

In order to compare and study the financing changes before and after listing, the validity and convenience of data, etc., this paper will select 100 companies listed in 2014, and these companies trade in the way of doing things. Since the relevant enterprise data in 2018 is not comprehensive enough, this paper selects the data years from 2014 to 2017 to ensure the validity of the data and the scientific nature of the analysis[1].

Table 1 Selection of Model indicators

Input factor indicators	Productivity indicators
Total assets	Total operating income growth rate
Operating costs	Return on equity
Asset-liability ratio	Total asset turnover

For the selection of relevant input and output indicators of the DEA model, this paper comprehensively considers the representativeness of the indicators, the correlation with the research object, and the convenience of data collection. Since this paper studies the financing efficiency of NEEQ companies, the relevant input, and output indicators have a wide range of choices. Under the premise of comprehensive consideration of various factors, this paper selects the following indicators as the model

ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

framework, as shown in table 1.

2.2 Empirical Results and Analysis

2.2.1 Average Annual Efficiency

Table 2 Average Annual Efficiency of Sample Companies

Annual	Technical efficiency(TE)	Net technical efficiency(PTE)	Scale efficiency(SE)
The year 2014	0.637	0.699	0.843
The year 2015	0.672	0.730	0.863
The year 2016	0.731	0.754	0.897
The year 2017	0.702	0.713	0.952

As shown in Table 2 above, during the data years, the technical efficiency, net technical efficiency, and scale efficiency of NEEQ-listed companies all showed a certain upward trend. First, in 2014, the net technical efficiency was 0.699. From then on, the value remained stable until 2016. Until 2017, the net technical efficiency of the NEEQ companies declined. Second, in terms of scale efficiency indicators, the NEEQ companies have shown a good growth trend during the data years. The scale efficiency has increased from 0.843 in 2014 to 0.952 in 2017. The scale efficiency has been at a high value and has gradually increased close to one, and this indicates that the effectiveness of the scale efficiency of the NEEQ companies is relatively high. Net technical efficiency has declined during the data years compared with scale efficiency. Therefore, the net technical efficiency of the NEEQ market needs to be improved, and enterprises need to focus on the development of net technical efficiency[2].

In addition, the NEEQ market has implemented a market business system since 2014, which is conducive to the efficiency of financing for NEEQ companies. According to the average value of efficiency calculated in this paper, the financing efficiency of NEEQ companies has indeed increased, showing a certain good trend; however, during the data years, the total scale of the national SME share transfer system began to expand on a large scale. Therefore, no clear conclusions can be drawn on whether the market business system can effectively improve financing efficiency.

2.2.2 Efficiency Distribution

According to the relevant research models in this paper, the efficiency value evaluation criteria of the NEEQ companies are divided into the following different ranges: when the efficiency value is 0≤ efficiency value<0.5, it indicates that the financing efficiency level of the decision-making unit is low and is in a relatively ineffective range; the equivalent efficiency value, when 0.5≤efficiency value<0.8, it indicates that the financing efficiency level of the decision-making unit is relatively low, and it is in a relatively inefficient range; when the efficiency value is 0.8≤efficiency value<1, it indicates that the financing efficiency level of the decision-making unit is relatively high and is in a low-efficiency range. When the efficiency value is equal to 1, it means that the financing efficiency level of the decision-making unit has reached the best state and is in the effective interval[3].

(1) Technical Efficiency

The technical efficiency distribution of sample companies in the data years is shown in Table 3 and Figure 1 below:

Table 3 Technical Efficiency Distribution of 100 Sample Companies from 2014 to 2017

Technical efficiency	The year 2014		The year 2015		The year 2016		The year 2017	
	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %
TE＝1	11	11	15	15	19	19	13	13
0.8≤TE＜1	12	12	18	18	19	19	19	19
0.5≤TE＜0.8	31	31	34	34	37	37	38	38
0≤TE＜0.5	46	46	33	33	25	25	30	30

From Table 1 and Figure 1 above, it can be concluded that from 2014 to 2016, the number of companies that can achieve the best level of financing efficiency has been increasing, indicating that these companies can achieve relatively good operating conditions and financing efficiency. It can be seen that this value is also relatively low, and by 2017, affected by the downward pressure on the economy, the number of NEEQ companies that can achieve the best level of financing efficiency has dropped to 13, showing a certain weakening trend. The number of companies in a relatively effective state shows a steady growth trend during the data years, indicating that the sample companies' overall comprehensive technical efficiency level is growing steadily during the data years. In addition, the number of enterprises

ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

at the lowest comprehensive technical efficiency level showed a decrease in the number of units in the data year as a whole, indicating that the new third board market has played a better and better role in financial integration. However, it cannot be ignored that although the number of NEEQ companies in a relatively effective state is increasing, during the data years, more than 50% of the companies are in a state of relatively low comprehensive technology level, with a slight decrease in the number[4].

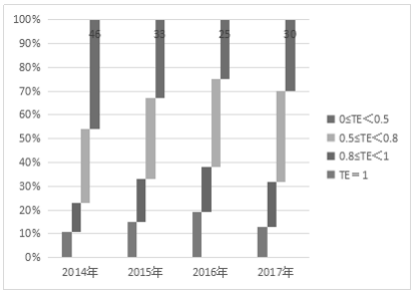

Figure 1 Technical Efficiency Distribution of 100 Sample Companies from 2014 to 2017

To sum up, from 2014 to 2017, the overall technical efficiency of NEEQ-listed companies was on the rise and improved, but overall, the technical efficiency of the entire market still has much room for improvement.

(2) Net Technical Efficiency

The distribution of net technical efficiency of sample companies in the data years is shown in Table 4 and Figure 2 below:

Table 4 Distribution of Net Technical Efficiency of 100 Sample Companies from 2014 to 2017

Net technical efficiency	The year 2014		The year 2015		The year 2016		The year 2017	
	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %
PTE＝1	16	16	22	22	27	27	23	23
0.8≤PTE＜1	20	20	17	17	14	14	21	21
0.5≤PTE＜0.8	30	30	28	28	36	36	35	35
0≤PTE＜0.5	34	34	33	33	23	23	21	21

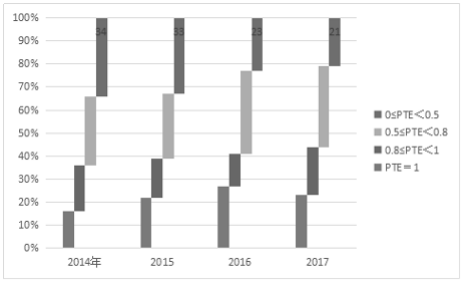

Figure 2 Distribution of Net Technical Efficiency of 100 Sample Companies from 2014 to 2017

From Table 4 and Figure 2 above, it can be concluded that from 2014 to 2016, the number of listed companies with the best level of net technical efficiency continued to increase. The proportion was also increasing, and it shows that enterprises with good production and operation status and high financing efficiency are constantly increasing[5].

According to the sample enterprise structure, some enterprises have been at the optimal net technical efficiency level, showing excellent financing efficiency advantages. However, similar to the level of comprehensive technical efficiency, in 2017, this value decreased. However, the number of enterprises with relatively high net technical efficiency has declined, which is shown in the above table. The number of enterprises with relatively low levels in the corresponding years has increased, which shows that some enterprises' net technology financing efficiency decreased during the data years, resulting in the above-mentioned proportional change. On the other hand, during the data years, the number of enterprises in the state of relatively ineffective net technical efficiency has steadily decreased year by year, indicating that the financing efficiency of the part of the enterprises in the lower level of financing efficiency has gradually improved[6].

To sum up, during the data years, the net technical financing efficiency level of NEEQ companies has improved overall, but their internal efficiency levels fluctuate greatly and are relatively unstable.

ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

(3) Scale Efficiency

The scale efficiency distribution of the sample companies in the data years is shown in Table 5 and Figure 3 below:

Table 5 Scale Efficiency Distribution of 100 Sample Companies from 2014 to 2017

Scale efficiency	The year 2014		The year 2015		The year 2016		The year 2017	
	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %
SE=1	11	11	15	15	30	30	13	13
0.8≤SE<1	33	33	67	67	54	54	51	51
0.5≤SE<0.8	46	46	11	11	9	9	29	29
0≤SE<0.5	10	10	0	0	0	0	0	0

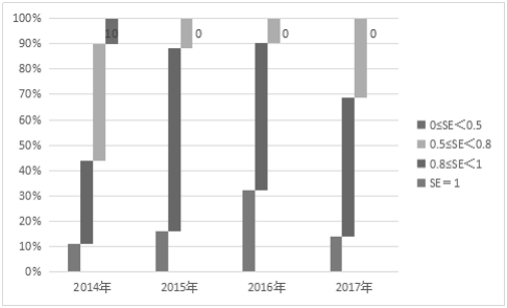

Figure 3 Scale Efficiency Distribution of 100 Sample Companies from 2014 to 2017

As shown in Table 5 and Figure 3 above, we can conclude that from 2014 to 2017, the number of companies listed on the NEEQ with the best scale efficiency continued to increase, indicating that some companies have better scale efficiency and higher financing efficiency. From the perspective of the internal sample enterprise structure, the scale efficiency of some enterprises has been in the best state, and these enterprises have shown a good level of financing efficiency advantage. However, the decline in the number of firms that were at their best in 2017 also contributed to the decline in overall technical efficiency in 2017. Different from the comprehensive technical efficiency and net technical efficiency, from 2015 to 2017, the number of listed companies with low scale efficiency was 0, indicating that during this data year, the scale efficiency of the NEEQ companies increased significantly. As the level rises, the scale financing efficiency shown by the NEEQ companies is better. However, since this paper only selects some sample data to evaluate the overall financing efficiency level, there may be some errors and accidents in the numerical value and conclusion. In addition, in 2014, the proportion of enterprises with high scale efficiency was 44%, while from 2015 to 2017, the proportion of enterprises with high scale levels was 89%, 91%, and 64%, all of which were greater than 50%, indicating that during the data years, the scale efficiency of the NEEQ companies has been greatly improved and increased. Under the circumstance that the performance of the net technical efficiency level is relatively fluctuating, the increase of the scale efficiency has become the main driving force for the increase of the comprehensive technical efficiency level[7].

(4) Return to Scale

The returns to scale of sample companies during the data years are shown in Table 6 and Figure 4 below:

Table 6 Distribution of Returns to Scale of 100 Sample Companies from 2014 to 2017

Return to Scale	The year 2014		The year 2015		The year 2016		The year 2017	
	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %	Qty.	Proportion %
Increment	75	75	57	57	50	50	70	70
Constant	13	13	19	19	32	32	15	15
Decrease	12	12	25	25	18	18	15	15

From Table 6 and Figure 4 above, it can be concluded that from 2014 to 2017, the number of NEEQ companies in the state of increasing returns to scale all accounted for more than 50%, indicating that most companies in the NEEQ market have increasing returns to scale. The main reason for this phenomenon is that most NEEQ companies are small and medium-sized enterprises in my country. In addition, from 2014 to 2016, the number of listed companies with constant returns to scale increased in varying degrees, which shows that the play of financing role of the NEEQ has played a certain role in alleviating the financing problems of small and medium-sized enterprises in my country. Some NEEQ companies have improved returns to scale. In addition, during the data years, the number of listed companies with diminishing returns to scale has increased, indicating that the production and operation

ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

conditions of some companies have not been improved by obtaining financing funds, and there are problems such as the blind expansion of production and poor use of funds. Such companies should strengthen the effective use of funds and improve the comprehensive management level of enterprises[8].

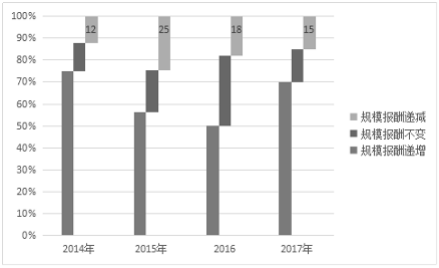

Figure 4 Distribution of Returns to Scale of 100 Sample Companies from 2014 to 2017

To sum up, under the operation of the NEEQ market platform, most small and medium-sized enterprises have obtained useful funds to promote the development of enterprise-scale and production. However, some enterprises cannot effectively use financing funds or have business operations, bad blind expansion, and other issues.

(5) Malmquist Total Factor Productivity Index Analysis

The calculation of this index uses the type-related data from 2014 to 2017, imports the data into Deap2.1, and uses different control parameters to calculate, thereby obtaining the total factor productivity change value of the sample enterprises and its average value[9]. The final calculation results are shown in Table 7 and Figure 5 below:

Table 7 2014-2017 Total Factor Productivity Changes and Average Composition

Years	Effch	Techch	Pech	Sech	TEPch
2014	1.284	1.152	1.027	1.251	1.486
2015	1.096	1.084	1.059	1.035	1.188
2016	1.025	0.952	1.046	0.925	0.893
2017	0.946	0.844	1.072	0.882	0.799
Average value	1.08775	1.008	1.051	1.02325	1.0915

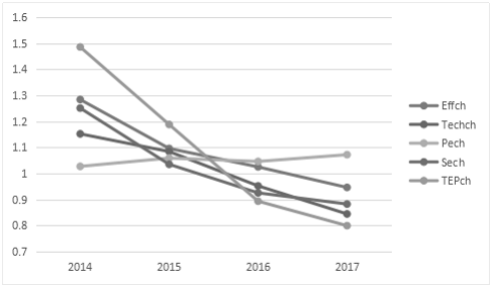

Figure 5 2014-2017 Total Factor Productivity Changes and Average Composition

From the above Table 7 and Figure 5, we can conclude that the change of the TFP index in 2014 and 2015 is greater than 1, and on this basis, the relevant decomposition values are also greater than 1, indicating that during the data years, there have been certain technological progress and steady growth of relative efficiency in the NEEQ companies. Of course, the value of each indicator in 2015 was lower than that in 2014, indicating that the growth momentum of the total factor productivity of enterprises listed on the NEEQ was lower than that in 2014, and the production and operation efficiency and technological progress of related enterprises were relatively weak. In 2016, only the change in net technical efficiency was greater than 1, indicating that production efficiency has always maintained a state of growth, but other values are less than 1, indicating that from 2016 to 2017, the total factor productivity of NEEQ enterprises has declined[10].

3. Conclusion

Through the above analysis of the overall mean of efficiency of the sample enterprises, the efficient

ISSN 2616-5902 Vol. 4, Issue 2: 59-64, DOI: 10.25236/AJBM.2022.040210

distribution of each detailed index, the return to scale, and the Malmquist total factor productivity index, this paper can summarize the following conclusions:

First, from the overall point of view, during the data years of this paper, the financing efficiency of the sample listed companies has improved to a certain extent. From 2014 to 2016, the comprehensive technical efficiency values of the sample companies have been increasing, showing a certain level of improvement in financing efficiency, and the scale efficiency of the multi-source data has greatly improved. Compared with this, the performance of net technical efficiency is relatively fluctuating, thus also leading to the decline of comprehensive technical efficiency in 2017. Therefore, NEEQ companies should focus on improving net technical efficiency to improve comprehensive technical efficiency.

Second, the prosperity and development of the NEEQ market have prompted most companies to increase returns to scale, which is conducive to the growth and development of small and medium-sized enterprises in my country. The financial integration of the NEEQ has put forward higher requirements. However, there are also phenomena such as the inability to use the financing after obtaining it effectively and the blind expansion of production leading to operational problems. Therefore, enterprises should be continuously guided to enhance the utilization efficiency of financing funds, pay attention to reducing costs and expenditures, and achieve high-quality development.

Third, the total factor production efficiency of the sample NEEQ-listed companies maintained an overall increase from 2014 to 2017 and decreased slightly in 2017, which shows that the financing of NEEQ companies during the data years did not significantly improve the operating efficiency of the company, to promote the vigorous development of enterprises.

Reference

[1] Yang Guozuo, Zhang Feng, Chen Ziyi. An Empirical Analysis of the Financing Efficiency of Companies Listed on the NEEQ companies [J]. Finance and Economics Theory and Practice, 2017,38(02):48-53.
[2] Shen Chen. Research on the Financing Efficiency of Small and Medium-sized Enterprises in the NEEQ Market——A Research on the Private Equity Issuance Based on the Three-stage DEA Model [J]. Audit and Economic Research, 2017,32(03):78-86.
[3] Jin Hui, Huang Jue. Financing Efficiency Evaluation of NEEQ Enterprises Based on Two-Stage DEA Model [J]. Productivity Research, 2017(09):29-33.
[4] Li Muchen, Ji Xuanming, Wang Kun. Financing Efficiency Evaluation of NEEQ Innovation Layer Manufacturing Enterprises Based on DEA Model [J]. Journal of Bengbu University, 2017,6(06):128-131+161.
[5] Meng Jiaying. Evaluation of Equity Financing Efficiency of Beijing NEEQ-listed Enterprises Based on DEA Model [J]. Operation and Management, 2018(01):101-104.
[6] Li Muchen, Ji Xuanming, Wang Kun. Financing Performance Analysis of NEEQ Innovation Layer Enterprises [J]. Productivity Research, 2017(11):44-47+161.
[7] Jin Hui, Huang Jue. Analysis of factors affecting the financing efficiency of my country's NEEQ enterprises [J]. Journal of Hangzhou Dianzi University (Social Science Edition), 2018,14(01):24-29.
[8] Yuan Zhuomiao, Wang Cong, Zhou Liqun. Research on the Financing Efficiency of the NEEQ Market for Tech-based Small, Medium, and Micro Enterprises——Also Analysis of the Path Selection to Solve the Problem of High Financing Costs for Tech-based Small, Medium, and Micro Enterprises [J]. Price Theory and Practice, 2018(01):110-113.
[9] Ma Hanjiang. Research on the financing efficiency of small and medium-sized enterprises in the NEEQ market [J]. Taxation, 2018(17):184.
[10] Wu Yangfen, Zeng Fanhua. Research on the Measurement of Financing Efficiency of Small and Medium Enterprises on the NEEQ in my country [J]. Hubei Social Sciences, 2019(01):69-77.