

# **Research on the Financing Performance of Listed Companies on my Countries Growth Enterprise Market-Based on DEA-Malmquist Index Analysis**



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**SUMMARY:** The Growth Enterprise Market, also known as the second board market, is a convenient and simple financing market for small and medium-sized enterprises that cannot meet the listing conditions of China's main board market in the short term and have a small growth and development space. In my country's Growth Enterprise Market, it has become a gathering place for high-tech companies such as biology and information technology, laying a foundation for my country's future development of high-tech technology, and strengthening my country's comprehensive national strength. This paper uses the DEA-Malmquist index method to analyze the financing performance of 10 listed companies on my country's GEM from 2016 to 2020, and draws the results of the study: different years of financing environment are different, which has a greater impact on the financing performance of GEM companies; Problems in the management of the funds raised by the target company's financing will have a greater negative impact on its financing efficiency.

**KEYWORDS:** Growth Enterprise Market; listed companies; financing efficiency; DEA-Malmquist index

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## **I. INTRODUCTION**

Since entering the new era, China's economic development has been in a new normal. Li Hui (2018) believes that at this stage, supply-side structural reforms carried out with the purpose of driving innovation and optimizing resource allocation have become a new driving force for economic growth<sup>[1]</sup>. According to our statistical data, under the actual conditions of various conditions, financing channels, and tight financing environment, the development of my country's socialist market economy and the construction of the socialist modern national economic system are still developing for small and medium-sized enterprises. Occupying an important leading position, about 60% of the great technological R&D and innovation every year after the 20th century are derived from the technological innovation small and medium-sized enterprises of my country's Growth Enterprise Market. Zheng Lixia (2014), Zhai Lei (2014), Gu Xiujie and others (2017) believe that innovative companies have the characteristics of high market share, high market value and strong profitability<sup>[2-3]</sup>. The main purpose of the Growth Enterprise Market is to support entrepreneurial, technological, and innovative small and medium-sized enterprises; it has relatively low listing thresholds, lower requirements on company equity, looser information disclosure systems than the main board market, and higher investment risks. Yang Xinyan (2017) and Xu Jie (2017), from the perspective of risk control of SME debt financing, believe that the construction of a scientific debt financing system can meet the actual needs of SME debt financing. At the same time, they analyzed in detail the status quo of internal operations and the effects of external financing environment. The impact of SME debt financing [4]. Song Hua (2019) and Chen Sijie (2019) proposed that small and medium-sized enterprises can use innovation as a channel of information transmission. To improve financing efficiency, information needs to be presented in the system<sup>[5]</sup>. In particular, to support high-growth, innovative and entrepreneurial strategic enterprises, it is necessary to provide capital technology guarantees for promoting the state to support independent development of innovative key strategic enterprises, and to propose an open and transparent capital

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supervision and incentive system for high-valued risk enterprises, in order to accelerate the establishment of A multi-level corporate capital flow market system is escorted. With the continuous expansion of financing service channels, it will inevitably change the original financing structure of the enterprise, and at the same time, it will inevitably have a certain impact on the business performance of the enterprise. This article takes the ten listed companies on my country's GEM from 2016 to 2020 as the main research objects, and explores the main influence of the financing capital structure of my country's GEM listed companies on the efficiency of corporate operations and management, hoping to improve the efficiency of the current my country's GEM listed companies' corporate financing structure Professional decision-making research on promotion provides a solid theoretical research foundation and decision-making guidance.

The DEA-Malmquist productivity index is an effective method to calculate the productivity index by measuring the total factor productivity of an enterprise and the decomposition of its index. Many experts and scholars refer to the Malmquist productivity index and its index as an enterprise after further calculation and decomposition. The change index of technical efficiency and the change index of enterprise technical efficiency. Nowadays, DEA-Malmquist productivity index method has become one of the main methods to measure and calculate the productivity and performance level of enterprises. Among them, Ma Weigang (2014) and Zhang Minglong (2015) conducted a static tracking analysis on the economic benefits of the interaction and combination of financial technology and emerging industry finance in more than 30 provinces (cities) in China in recent years, and then used the Malmquist index analysis method to separately analyze the economic benefits. From 2006 to 2012 and from 2007 to 2012, China's emerging industries, technology and finance, have made long-term dynamic tracking and analysis on the three indicators of technology scale operation efficiency, pure information technology application efficiency, and contribution rate of scientific and technological progress. It is found that the current financial resources in our country have not been able to achieve reasonable and effective utilization and allocation. These are an important reason for the positive and negative growth of the benefits of the combination of technology and finance<sup>[6-7]</sup>. Li Qiang (2020) uses the DEA-Malmquist model to evaluate the agricultural production efficiency of Jilin Province from 2004 to 2017 and 9 cities in Jilin Province in 2017. Through calculations, the overall agricultural production efficiency of Jilin Province is relatively high, but there is still room for improvement. , The province's technological progress rate is low, restricting the increase in total factor productivity<sup>[8]</sup>.

From the study of this article, it can be seen that the financing efficiency of SMEs has an important impact on their own development, and improving financing efficiency is of great significance to the development of enterprises. Therefore, this article will conduct some empirical analysis and research on the financing performance of listed companies on the Growth Enterprise Market, and put forward suggestions based on the research results to improve their financing efficiency to ensure the stable development of enterprises.

## 2. RESEARCH METHODS

### (1) Super efficiency DEA

The traditional DEA model cannot compare situations where the efficiency value is greater than 1, and its conditional restrictions are relatively strict. The super-efficiency DEA model is a linear program formed by introducing slack variables on the basis of the traditional DEA model, which can make up for the inability to compare and single after the decision-making unit reaches efficiency Study the situation from the perspective of the problem. Assuming that there are n decision-making units, and each decision-making unit has m inputs and s outputs, which are represented by input variables X and output variables Y respectively, the expression of the super-efficiency DEA model is as follows:

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

$$\text{S.t } \sum_{j=1, j \neq k}^n x_{ij} \lambda_j + s_i = \theta x_0 \quad (2)$$

$$\sum_{(j=1, j \neq k)}^n y_j \lambda_j - s_r^- = y_0 \quad (3)$$

$$\lambda_j \geq 0; j=1, 2, \dots, k-1, k+1, n$$

$$s_i^- \geq 0; s_r^+ \geq 0$$

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Where is the efficiency value of the decision-making unit, is the weight vector corresponding to the decision-making unit and is a slack variable, is the  $i$ -th input variable of the  $k$ -th decision-making unit, and represents the  $j$ -th output variable of the  $k$ -th decision-making unit.

### (2) Malmquist index method

Banker et al. (1984) believed that the assumption of constant returns to scale in the CCR model was too strict, so they studied and improved the model, and then constructed a BBC model assuming variable returns to scale<sup>[9]</sup>. In the previous years, Charnes et al. (1978) have clearly proposed the use of a data packet road network (DEA) model in the paper to analyze and compare the relative efficiency of multiple service units that provide different homogeneous information services. , DEA model has been widely used in my country's financial service industry and various government departments to study how to calculate the relative efficiency parameter value of information; this model can be objectively based on multiple input indicators and multiple output indicators of the same type. The relative validity situation calculates a set of objective values<sup>[10]</sup>. It shows that we can make an objective numerical evaluation of the relative benefits of the economic service system through multiple indicator inputs and production of multiple indicators within the same range. This theoretical model is now being widely used, mainly in my country's industrial, financial The calculation of relative benefits in different service fields and government departments.

In order to analyze the financing efficiency of the selected 10 sample companies, this paper will apply the DEA-Malmquist index method to analyze the different degrees and reasons of the financing efficiency of listed companies on the ChiNext.

Because the DEA model can only compare the efficiency values of different decision-making units in the same period, it cannot accurately measure the continuous changes of the decision-making efficiency values in different periods, which has great limitations. In 1994, Fare et al. combined DEA-Malmquist's index theory and DEA method for the first time, and proposed the DEA-Malmquist model. Hypothesis( $x^t, y^t$ ) Represents the input and output of the  $t$  period, ( $x^{t+1}, y^{t+1}$ ) Represents the input and output of period  $t+1$ ,  $D_c^t(x^t, y^t)$ 、 $D_c^{t+1}(x^{t+1}, y^{t+1})$  Respectively, as a function of the output gap distance under technical conditions corresponding to a period, the subscript  $c$  represents the constant rate of return on scale. Then the Malmquist index can be expressed by the following formula:

$$\text{Effch} = \frac{D_c^{t+1}(x^{t+1}, y^{t+1})}{D_c^t(x^t, y^t)} \quad (1)$$

$$\text{Tech} = \left[ \frac{D_c^t(x^{t+1}, y^{t+1})}{D_c^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_c^t(x^t, y^t)}{D_c^{t+1}(x^t, y^t)} \right]^{1/2} \quad (2)$$

$$\text{Effch} = \frac{D_c^{t+1}(x^{t+1}, y^{t+1})}{D_c^t(x^t, y^t)} \quad (3)$$

$$\text{sech} = \left[ \frac{D_v^{t+1}(x^{t+1}, y^{t+1})/D_c^{t+1}(x^{t+1}, y^{t+1})}{D_v^t(x^t, y^t)/D_c^t(x^t, y^t)} \times \frac{D_v^{t+1}(x^{t+1}, y^{t+1})/D_c^{t+1}(x^{t+1}, y^{t+1})}{D_v^t(x^t, y^t)/D_c^t(x^t, y^t)} \right]^{1/2} \quad (4)$$

$$\text{tfp} = M^{t+1}(x^{t+1}, y^{t+1}, x^t, y^t) = \left[ \frac{D_c^t(x^{t+1}, y^{t+1})}{D_c^t(x^t, y^t)} \times \frac{D_c^{t+1}(x^{t+1}, y^{t+1})}{D_c^{t+1}(x^t, y^t)} \right]^{1/2} \quad (5)$$

The formula (1) is the technical efficiency, the formula (2) is the technological progress, the formula (3) is the pure technical efficiency, the formula (4) is the scale efficiency, and the formula (5) is the total factor productivity.

If when  $M_{t+1}(x_{t+1}, y_{t+1}, x_t, y_t) < 1$ , it means that the overall productivity of the entire linear factor has decreased; in addition, if when  $M_{t+1}(x_{t+1}, y_{t+1}, x_t, Y_t) = 1$ , it means that the overall productivity of the full linear factor remains unchanged; in addition, if  $M_{t+1}(x_{t+1}, y_{t+1}, x_t, y_t) > 1$ , it represents the overall full linear factor Productivity will increase.

Among them,  $\text{tfp} = M_{t+1}(x_{t+1}, y_{t+1}, x_t, y_t) = \text{Effch} \times \text{Tech}$ . While the value of  $(x_{t+1}, y_{t+1})$  represents the immutability of the actual return of a certain scale, based on the output distance function of the specific technical indicator conditions of the first  $t+1$  period, the following index  $v$  value represents a certain scale The actual remuneration is variable. Then its variation range index in technical variation performance can be expressed as:  $\text{effch} = \text{pech} \times \text{sech}$ .

Therefore, the basic calculation formula of total factor productivity is generally expressed as follows:  $\text{tfp} = \text{Effch} \times \text{Tech} = \text{pech} \times \text{sech} \times \text{tech}$

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## 3. SYSTEM CONSTRUCTION

### (1) Selection of indicators and data sources

Based on the authenticity and availability of the data, this article selects 10 sample companies from the GEM listed companies publicly disclosed by the Shenzhen Stock Exchange, and uses their 2016-2020 financial statements as the basis to obtain the required financial indicators from the annual financial statements , Confirm the sample. See table 1

**Table 1. Codes and names of selected sample GEM listed companies**

Serial number	Securities code	Securities abbreviation	Serial number	Securities code	Securities abbreviation
1	300059	Eastern Fortune	6	300027	Huayi Brothers
2	300433	Lens Technology	7	300315	Palm Fun Technology
3	300185	Tongyu Heavy Industry	8	300144	Songcheng Performing Arts
4	300070	Greenwater	9	300182	Jebsen
5	300251	Light Media	10	300296	Leyard

Select investment indicators, financing scale, financing risk, and financing time, and determine the corresponding variables. The company’s financing scale is represented by asset-liability ratio, financing risk is represented by equity ratio, and financing time is represented by funding speed; the selected output indicators include the company In recent years, the three indicators of profitability, development ability and operating ability, and at the same time, the operating ability is expressed by the total asset turnover rate, the development ability is expressed by the net profit growth rate, and the profitability is expressed by the net asset interest rate. See Table 1 for the specific input and output indicator system.

**Table 2. The financing performance evaluation index system of listed companies on the Growth Enterprise Market**

Input/Output	Indicator name	Indicator variable	Variable description
Investment index	Financing scale	Assets and liabilities	Total liabilities/total assets
	Financing risk	Equity ratio	Total liabilities/total owners' equity
	Financing time	Funding speed	Operating income/net cash inflow from financing activities
Output indicators	Profitability	Net asset interest rate	Net profit/average total assets
	Operating capacity	Turnover rate of total assets	Operating income/average total assets
	Development ability	Net profit growth rate	Increase in total net profit this year/total net profit last year

### (2) Empirical analysis:

The 2016-2020 data of the 10 GEM listed companies are selected and organized, and then the DEA-Malmquist index method is used for calculation and analysis, and the average annual Malmquist index and decomposition for 2016-2020 are obtained respectively, and the 2016-2020- The super-efficiency DEA value and situation of 10 GEM listed companies in 2020.

#### 1. Based on super efficiency DEA analysis

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**Table 3. The super-efficient DEA values of 10 listed companies on my country's GEM from 2016 to 2020**

category	2016	2017	2018	2019	2020	average value	Rank
Oriental wealth	0.5909091	0.6363636	0.7380952	1.0000000	1.0000000	0.79307358	6
Lens Technology	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.00000000	1
Tongyu Heavy Industry	1.0000000	0.4117647	1.0000000	0.4705882	1.0000000	0.77647058	7
Bishuiyuan	0.5416667	0.5833333	0.4113475	0.3750000	0.1645348	0.41517646	10
Light Media	0.9655172	0.5833333	1.0000000	0.5325885	1.0000000	0.81628780	5
Huayi Brothers	0.5652174	0.8750000	0.4808511	1.0000000	0.2000000	0.62421370	8
Palm Fun Technology	0.7222222	1.0000000	0.9285714	1.0000000	1.0000000	0.93015872	3
Songcheng Performing Arts	1.0000000	1.0000000	1.0000000	1.0000000	0.5178571	0.90357142	4
Jebsen	1.0000000	0.5000000	0.6539007	0.3061224	0.2699468	0.54599398	9
Riad	1.0000000	1.0000000	1.0000000	1.0000000	0.9431400	0.98862800	2

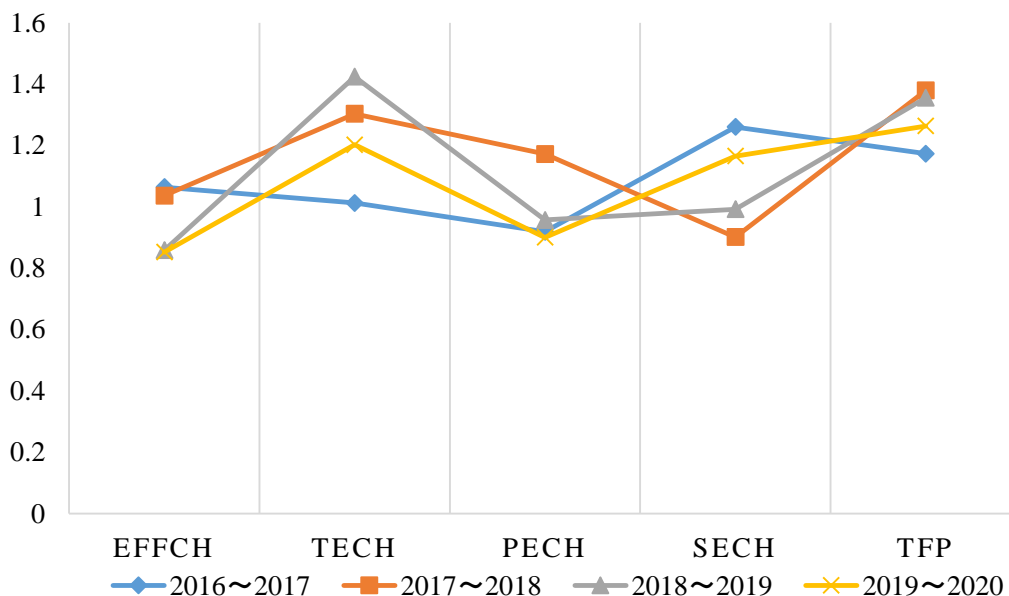
Table 2 shows the super-efficiency DEA values of 10 sample companies from 2016 to 2019. Among them, the efficiency value of Lens Technology, Leyard, and Palm Fun Technology ranks in the top three. The average value of super-efficiency DEA is higher, and the efficiency is higher. The value is maintained at about 1, indicating that the efficiency values of these three companies are in a high state; while the efficiency values of the three companies of Huayi Brothers, Jebsen Stock, and Bishuiyuan are low and have a large difference from the first three, indicating that the selected sample The company's production and operation are not balanced, and the efficiency value needs to be improved.

**2. Based on DEA-Malmquist index**

The data of the sample enterprises from 2016 to 2020 are standardized, and then the Malmquist index is obtained, and the total factor production efficiency index of different annual intervals is obtained. The results are shown in Table 2. As can be seen from Table 2 and Figure 1, the total factor productivity index for the next four years is 1.174, 1.380, 1.356, and 1.246 based on the 2016 total factor productivity index. The total factor production index has declined from 2016 to 2018. Trend, the total factor production index from 2018 to 2020 shows an upward trend, with an annual average of 1.294, indicating that the financing efficiency of selected GEM companies has increased by an average of 29.4% in 6 years, mainly due to technical factors, including technological progress. The index is much greater than 1. In terms of economies of scale, the immaturity of economies of scale may reduce financing efficiency, but from the analysis of the results, the annual average value of economies of scale reaches 1.081, and the average growth rate is 8.1%. This can indicate that economies of scale are getting better day by day.

**Table 4. The Malmquist Index of Financing Efficiency of 10 Listed Companies on my country's Growth Enterprise Market from 2016 to 2020**

time	effch	tech	pech	sech	tfp
2016~2017	1.065	1.013	0.919	1.261	1.174
2017~2018	1.037	1.304	1.173	0.902	1.380
2018~2019	0.859	1.425	0.958	0.993	1.356
2019~2020	0.853	1.203	0.901	1.166	1.264
Mean	0.954	1.236	0.988	1.081	1.294



**Figure 1. The financing efficiency M index and its decomposition items of 10 listed companies on my country's Growth Enterprise Market from 2016 to 2020**

As shown in Figure 1, in summary, from the perspective of the development from 2016 to 2020, the technical efficiency of the selected 10 sample companies has shown a relatively obvious downward trend, and the efficiency of technological progress is relatively stable, fluctuating around the average value. Overall, it is relatively stable. The average value of the total factor productivity index is 1.294, which is greater than 1, indicating that the output efficiency of the selected sample companies in the five years has shown an overall upward trend. Among them, the total factor productivity increased by 38% from 2017 to 2018, becoming the stage with the largest increase in 5 years. A detailed analysis of total factor productivity found that the average values of technological progress and scale efficiency were both greater than 1, an average annual increase of 23.6% and 8.1% respectively, indicating that the selected sample company may have introduced or developed new technologies within this time frame, but At this time, although the scale efficiency value has risen but it has not matched the technological progress value, it can be seen that the company should expand the scale of production and operation at the same time as technological progress, and strive to form the best production scale; but because the pure technical efficiency change index is less than 1, it shows The average annual pure technology level drops by 1.2%; the average value of the technical efficiency change index is 0.954, which is less than 1, indicating that the average annual technology level drops by 4.6%. Therefore, on the whole, whether the total factor productivity can be further improved has a certain relationship with the technical level, and the improvement of the company's financing efficiency should make greater efforts in the company's scale and technology.

#### **4. CONCLUSIONS AND RECOMMENDATIONS**

##### **(1) Conclusion**

This paper uses the DEA-Malmquist index to analyze the financing performance of 10 companies listed on my country's GEM, and draws the main conclusions as follows:

First, the financing efficiency of the selected sample companies is not high, and it fluctuates significantly within the time frame of the selected study, and is unstable; at the same time, financing efficiency is affected and restricted by many factors, and the risks caused by these factors should be avoided in actual situations. .



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Second, from the perspective of the pure technical efficiency change index level, the overall level of technical efficiency changes of the sample companies within the research time limit is relatively low and has continued to decline in the past two years. This shows that the sample companies have certain risks in the management of financing funds and financing process, and this will have a certain degree of negative impact on the company's financing efficiency.

Third, the overall scale and efficiency of listed companies on the GEM have maintained a relatively high level. During the study period, the scale and efficiency of the sample companies are all high and maintained in a relatively stable state. Only a few companies have large fluctuations. This shows that the financing scale is close to the optimal financing scale, but the financing environment and other factors will cause the financing scale to deviate greatly from the optimal financing scale.

### (2) Suggestions

1. Improve the loan model for SMEs and simplify the loan procedures. GEM companies are mostly entrepreneurial, innovative, and high-tech small and medium-sized enterprises, mainly focusing on the development of high-tech technology. Their equity structure is immature and most of them have no fixed assets that can be used as collateral. Therefore, lending institutions or banks can form a model that uses future profits as collateral to estimate the future benefits of the company's technology.
2. Implement the plan of introducing innovative and technological talents. Technological innovation is inseparable from high-tech talents. Small and medium-sized enterprises can establish a targeted talent training system with universities from the source to encourage graduates to find employment in high-tech small and medium-sized enterprises. At the same time, the government should implement supporting policies for settlement in different places and financial subsidies. In order to retain talents for SMEs.
3. The government issues incentive policies for SMEs. The government ensures open, transparent, stable and effective fiscal policy support, and provides corresponding tax reduction and exemption policy support for small and medium-sized enterprises that meet the requirements. Under the same conditions, technology-based small and medium-sized enterprises will be given priority in the supply of goods, help solve the problem of product sales, and allow technology-based products to flow into the market to form a complete capital chain.
4. Enterprises improve their competitiveness and strengthen technological innovation. Technological SMEs are mainly based on technological innovation. Technological innovation is an important factor in the company's sustainable development. It should correctly understand its own competitive advantages and future challenges, and make timely response strategies to achieve sustainable development.

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