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Research Article

Performance Evaluation of Financial Support for Transformation of Military Scientific and Technological Achievements Based on Machine Learning and PCA

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The first motive force of development is innovation. If we want to enhance the driving force of industrial development, we must transform the achievements of scientific and technological innovation effectively. Developing strategic emerging industries is one of the most important tasks of our country now. The combination of machine learning and PCA financial support is very important for the transformation of military scientific and technological achievements (STA) in China. Based on PCA, this paper selects some representative input-output indicators. According to the survey, China's strategic resource allocation has an impact on emerging industries, and there is room for optimization. The form of ownership of a company, whether it holds two positions concurrently, the financial results, and the rights and interests of some shareholders have obvious bad effects on comprehensive efficiency, while the time of establishment and the location of the company have obvious good effects on comprehensive efficiency.

1. Introduction

The transformation of scientific and technological achievements (STA) is an important part of the national scientific and technological innovation system. This paper analyzes the present situation of the TSTA and finds out the reasons for the low conversion rate [1]. Market failure leads to the TSTA, which requires government intervention. This paper lists some successful actions of foreign countries in the TSTA and probes into the role of Chinese government in the TSTA [2]. Submit new ideas and suggestions on scientific management of agricultural science and technology transformation funds [3]. The transformation mechanism of agricultural STA is closely related to economic changes. Implementing the multilateral operation mechanism supported by multichannel, multifield, and multifield STA, the background and characteristics of the two mechanisms are conducive to fundamentally solving the economic dislocation between agricultural economy and agricultural science and technology and improving the transformation efficiency of agricultural STA [4]. Since the reform and opening up, China's agriculture has achieved great success, which is due to the progress of agricultural science and technology. By analyzing the project preparation, layout, and project implementation units, we can summarize the impact of project implementation, summarize the successful experience, and do a good job. Better yet, measures such as making long-term project plans, strengthening financial support, and establishing long-term mechanisms are put forward to ensure the effective use of funds [5].Technological progress contribution index shows that policy index is the most important evaluation index and plays a decisive role in the "Agricultural Scientific and Technological Achievements Transformation Fund" [6]. There are many factors restricting the transformation of agricultural STA, such as weak agricultural scientific research system, lack of STA, limitations of agricultural STA, and insufficient demand for agriculture [7]. There are many problems, such as slow TSTA, low quality, disconnection with social needs, lack of legal system, and so on. Environment and market mechanism are obstacles hindering China's scientific and technological innovation system [8]. Academic level is the main index to

evaluate the transformation of basic research results, and comprehensive influence is the main index to evaluate the transformation of soft science performance [9]. The transformation and promotion of achievements have common relations and differences. Performance conversion standards are expressed by conversion degree, conversion rate, and conversion index [10, 11]. If all inputs and outputs are included in the efficiency assessment of the analyzed unit, then everything is completely efficient, so discrimination can be increased by reducing the number of factors. To address this weakness, we recommend using PCA to merge input and output data [12]. Combined with the business characteristics of insurance companies, using the core idea of PCA, the monitoring index system of money laundering risk of insurance companies is constructed from two dimensions of internal risk factors and control factors [13]. Based on the results of PCA analysis, various PCA-DEA formulas are developed, and the application of PCA can significantly improve the strength of DEA model [14]. PCA and BPNN methods are used to establish credit risk early warning models for Internet finance companies, and the methods are verified by case studies [15]. The author uses PCA to reduce dimensions and save a lot of calculation time. Through HJM and PCA framework, forward-looking methods are applied to portfolio environment [16]. Machine learning method is especially suitable for fields with more data but less theory. The goal of machine learning is to extract useful information from a large amount of data by building a good probability model and automating the process as much as possible [17]. Machine learning has no magic, no hidden power, and no alchemy, only a set of recognizable practical technologies can extract useful information from raw data [18]. In the past ten years, the processor speed has not kept up with the pace of data growth. Therefore, computing time is an important reason for limiting statistical machine learning, which more accurately exposes the quality difference between large-scale and small-scale learning [19]. It is written in three aspects: first, it introduces Monte Carlo method; second, it studies the main parts of modern Markov Monte Carlo chain simulation; and third, it discusses interesting new research fields. [20].

2. Single Classification of Machine Learning Algorithms

2.1. Overview of Single Classification Algorithm

2.1.1. ANN. ANN is a classical machine learning algorithm. The MP model proposed by McCulloch and Pitts proves that a single neuron can perform logical functions. ANN classification adjusts the parameters of ANN according to specific training samples, so that the output of ANN is close to the class label of known samples. The input layer, hidden layer, and output layer are the basic components of BP, as shown in Figure 1.

2.1.2. Naive Bayes. For classified samples, Bayesian formula finds the posterior probability that the samples belong to a specific category according to the previously known probability and then selects the category with the highest posterior probability for the category to which the samples belong.

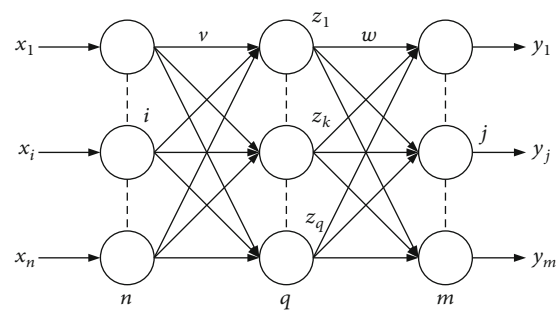


Figure 1: Structure diagram of three-layer neural network.

The Naive Bayesian classifier uses probability calculation, assuming that the text d_i to be classified belongs to a certain class c_j of the given text class C, and the Naive Bayesian classifier can get

$$p(c_j|d_t) = \frac{p(c_j)p(d_i|c_j)}{p(d_i)}, \tag{1}$$

$$p(d_t) = \sum_{j=1}^{k} p(c_j)p(d_i|c_j). \tag{2}$$

Then, calculate the probability of a given text set D in the case of inputting d_i, and the maximum probability value obtained indicates that this category is the category of d_i, and formula (3) can be obtained.

$$d_i \in c_j \text{ if } p(c_j|d_i) = \max_{l=1,\cdots k} \{p(c_l|d_i)\}. \tag{3}$$

2.1.3. K-Nearest Neighbor. The sample category to be classified has the largest category share. Aiming at the shortcomings of KNN algorithm, an improved KNN algorithm is proposed, such as nearest neighbor rule enrichment method, prototype generation or modification method, and multiclass combination method.

The basic principle of KNN algorithm is to find K-nearest neighbor sample nodes and then calculate the distance between the sample to be classified and its surrounding samples according to the following two formulas:

(1) Euclidean distance formulas such as the following:

$$D(a, b) = \sqrt{\sum_i (a_i - b_i)^2}. \tag{4}$$

(2) Cosine distance formulas such as the following:

$$\rho(a, b) = \cos(a, b) = \frac{a \cdot b}{|a||b|}. \tag{5}$$

2.2. Classification Performance Evaluation Index

2.2.1. Precision and Recall. For precision, the calculation formula is as follows:

$$\text{precision} = \frac{\text{TP}}{\text{TP} + \text{FN}}. \tag{6}$$

For recall ratio, the calculation formula is as follows:

$$\text{recall} = \frac{\text{TP}}{\text{TP} + \text{FP}}. \tag{7}$$

2.2.2. F_β Value. F_β value is put forward in order to fully consider the classification performance of the classifier after comprehensive consideration of recall and precision. The relative importance of the two is expressed by β, and the calculation formula of F_β is as follows:

$$F_\beta = \frac{(1 + \beta) \times \text{precision} \times \text{recall}}{\beta^2 \times \text{precision} + \text{recall}}. \tag{8}$$

In practical application, the value of β is often set to 1, so the commonly used formula F_1 is as follows:

$$F_1 = \frac{2 \times \text{precision} \times \text{recall}}{\text{precision} + \text{recall}}. \tag{9}$$

2.2.3. Macroaverage and Microaverage. Formulas for calculating macroaverages are as follows:

$$\text{McaAvg\_Precision} = \frac{\sum_{j=1}^{|c|} \text{Precision}_j}{|C|}, \tag{10}$$

$$\text{McaAvg\_Recall} = \frac{\sum_{j=1}^{|c|} \text{Recall}_j}{|C|}, \tag{11}$$

where the denominator in the formula represents the total number of categories in the text set.

The formulas for calculating microaverage are as follows:

$$\text{MicAvg\_Precision} = \frac{\sum_{j=1}^{|c|} \text{TP}_j}{\sum_{j=1}^{|c|} \left(\text{TP}_J + \text{FP}_J\right)}, \tag{12}$$

$$\text{MicAvg\_Recall} = \frac{\sum_{j=1}^{|c|} \text{TP}_j}{\sum_{j=1}^{|c|} \left(\text{TP}_J + \text{FN}_J\right)}. \tag{13}$$

2.2.4. BEP. Because the precision rate and recall rate of evaluation index are a pair of contradictions and their values are inversely proportional, we cannot achieve high precision rate and recall rate. We need to balance these two indexes, so break-even point (BEP) is put forward. The value where the precision and recall are equal is BEP. Usually, the arithmetic average of precision and recall is used to express the value of BEP, and the calculation formula is as follows:

$$\text{BEP}_J = \frac{\text{precision}_j + \text{recall}_j}{2}. \tag{14}$$

The macroaverage of BEP and the microaverage of BEP are calculated as follows:

$$\text{MacAvg\_BEP} = \frac{\sum_{j=1}^{|c|} \text{BEP}_j}{|C|}, \tag{15}$$

$$\text{MacAvg\_BEP} = \frac{\sum_{j=1}^{|c|} \text{precision}_j + \text{recall}_j}{2}. \tag{16}$$

3. Sample Selection and Research Tools

3.1. Sample Selection and Data Processing. The index selection is divided into two steps: first, select the initial index, and choose as wide a range as possible; secondly, the PCA method is used to filter the main components of the above indicators as the best representative indicators of input indicators and output indicators.

3.2. Introduction to PCA Analysis. To measure the efficiency of financial assistance quantitatively, the most important thing is to choose appropriate input-output indicators. Now we mainly select a group of single indicators in the financial statements, such as operating income and profit in the income statement as indicators to measure output. The balance sheet and the statement of changes in equity use equity as a measure of investment. It is difficult to ensure the rigor of the research by selecting indicators in this way.

The main components selected by PCA are the linear combination of the original indexes, which are comprehensive indexes weighted according to the contribution rate, so the reliability of the indexes can be guaranteed. The former characteristic variables (set as m) are combined into a few variables (set as n and $n < m$), and n variables can completely represent the former m characteristic variables, while n comprehensive variables are irrelevant to each other. $X_t = (X_1, X_2, \cdots, X_m)^T$ is a random vector of m dimension. The covariance matrix $V.Y_1, Y_1, \cdots, Y_n (n \le m)$ is a new variable obtained by deforming $X_1, X_2, \cdots, X_m$, and it is not related to each other. So, $Y_t = a_1^T X_t = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1m}x_m$, where $a_1 = (a_{11}, a_{12}, \cdots, a_{1m})^T$ is a vector that is not zero. In order to find out the characteristics of the original m variables to the maximum extent of Y_t, it is equivalent to the maximum variance of Y_t after $X_1, X_2, \cdots, X_m$ change, that is,

$$\begin{aligned} DY_t &= D\left(a_1^T X\right) = E\left(a_1^T X - E\left(a_1^T X\right)\right)^2 \\ &= E\left(a_1^T X - E(X)\right)^2 \\ &= E\left(a_1^T (X - E(x))\left(X - E(x)^T a_1\right)\right) \\ &= a_1^T E(X - E(x))(X - E(x))^T a_1 \\ &= a_1^T V a_1. \end{aligned} \tag{17}$$

It can be seen that a_1 constrains the size of DY_t and is positively correlated, so matrix a_1 is required to be a contract matrix; that is, $a_{12}x_2 = 1$. Therefore, under the known constraint conditions, when the value of DY_t is maximized, the value of a_1 is obtained, and formulas (18), (19), and (20) are obtained according to Lagrange multiplier method

$$\phi(a_1, \lambda) = a_1^T - \lambda\left(a_1^T a_1 - 1\right), \tag{18}$$

$$\begin{cases} \dfrac{\partial \phi}{\partial a_1} = 2Va_1 - 2\lambda a_1 = 0, \\ \dfrac{\partial \phi}{\partial \lambda} = -2a_1^T + 1 = 0, \end{cases} \tag{19}$$

$$\begin{cases} Va_1 = \lambda a_1, \\ a_1^T = 1, \\ Dy_1 = a_1^T Va = a_1^T \lambda a_1 = \lambda. \end{cases} \tag{20}$$

In the above formula, λ is the largest characteristic root, that is, the variance of Y_t. a_1 is the eigenvector corresponding to the largest eigenroot. By combining the eigenvector with $Y_t = (X_1, X_2, \cdots, X_m)^T$, $Y_t = a_1^T = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1m}x_m$ is obtained. In the same way, according to this idea, the principal component before N can be obtained.

3.3. DEA

3.3.1. Introduction of DEA Model. In the analysis of multiobjective output and multiattribute input, the DEA model is widely used. It is a method based on relative efficiency evaluation. Decision-making unit efficiency means that the multioutput optimization solution falls on the production possibility boundary. Nonparametric statistical DEA models include C^2R and BC^2, e.g., formula (21) and formula (22):

$$\begin{cases} \min \theta \\ \text{s.t} \sum_{j=1}^{n} \lambda_j x_j + s^- = \theta_{x_0} \\ \sum_{j=1}^{n} \lambda_j y_j - s^+ = y_0 \quad \lambda_j \geq 0; j = 1, 2, \cdots, n \\ \sum_{j=1}^{n} \lambda_j = 1 \quad s^+ \geq 0; s^- \geq 0 \end{cases} \tag{21}$$

Parameter θ in formula (21) is technical efficiency; λ is a variable parameter; s^- is the slack variable of output; s^+ is the relaxation variable of input. By relaxing the above assumption of CRS, under the premise of VRS, a BC^2 model is produced.

$$\begin{cases} \min \theta \\ \text{s.t} \sum_{j=1}^{n} \lambda_j x_j + s^- = \theta_{x_0} \\ \sum_{j=1}^{n} \lambda_j y_j - s^+ = y_0 \quad \lambda_j \geq 0; j = 1, 2, \cdots, n \\ \sum_{j=1}^{n} \lambda_j = 1 \quad s^+ \geq 0; s^- \geq 0 \end{cases} \tag{22}$$

Parameter θ in formula (22) denotes PTE_{VRS}. The comprehensive technical efficiency of C^2R measure is decomposed into two parts: PTE_{VRS} andSE. Add convexity hypothesis to C^2R. From the derivation process, we can see that$\text{PE}_{\text{CRS}} = \text{SE} \times \text{PTE}_{\text{VRS}}$.

3.3.2. Mathematical Principle of DEA

(1) Input-Oriented DEA Measurement. The basic idea of input-oriented DEA measurement is to determine output under the condition of reducing input. Assuming that the return to scale of DMU is constant, and there are two input indicators set as X_1 and X_2 and a single output indicator set as Y, the efficiency performance of input-oriented DEA is shown in Figure 2.

In Figure 2, the SS' curve represents the unit equal yield curve of total efficiency; P point represents the unit output realized by fixed input; QP represents technical inefficiency, that is, the amount of input reduced proportionally under the premise of fixed output. The technical efficiency TE of DMU is expressed by QP/OP, which represents the corresponding reduction ratio of all inputs, and its value range is [0, 1], which represents the index of technical ineffectiveness of DMU, and its calculation formula is as follows:

$$\text{TE} = \frac{OQ}{OP}. \tag{23}$$

If the price ratio of input elements is expressed by AA', then AE represents the total efficiency allocation efficiency with P as the input amount, and its calculation formula is as follows:

$$\text{AE} = \frac{\text{OR}}{OQ}. \tag{24}$$

The comprehensive efficiency EE is expressed as OR/OP, which is also the product of technical efficiency and configuration efficiency, and its calculation formula is formula (25)

$$\text{EE} = \frac{\text{OR}}{OP} = \left(\frac{OQ}{OP}\right) \times \left(\frac{\text{OR}}{OQ}\right) = \text{TE} \times \text{AE}. \tag{25}$$

(2) Output-Oriented DEA Measurement. The basic idea of output-oriented measurement is to maximize output without

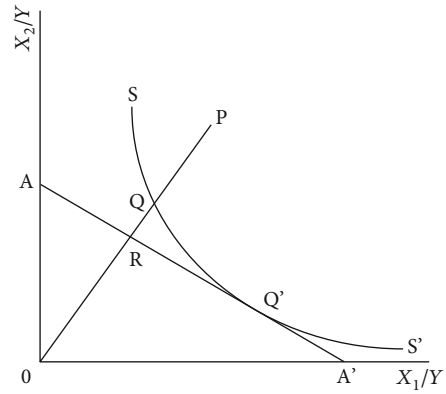


Figure 2: Input-oriented DEA technology and configuration efficiency.

changing input. If the total efficiency returns to scale are constant and there is one input index (X) and two output indexes (Y_1 and Y_2), the output-oriented DEA efficiency is shown in Figure 3.

As shown in Figure 3, ZZ' represents the highest possible line of DMU production. A is below the equal yield curve, which refers to the inefficiency unit. The degree of technical ineffectiveness is expressed by the distance AB, that is, the amount of output that can be increased if the input is determined. The output-oriented technical efficiency TE is expressed by the calculation formula as follows:

$$\mathrm{TE} = \frac{OA}{OB}. \tag{26}$$

If the price is represented by DD', the allocation efficiency AE is calculated as follows:

$$\mathrm{AE} = \frac{OB}{OC}. \tag{27}$$

The calculation formula of comprehensive efficiency EE is

$$\mathrm{EE} = \frac{OA}{OC} = \left(\frac{OA}{OB}\right) \times \left(\frac{OB}{OC}\right) = \mathrm{TE} \times \mathrm{AE}. \tag{28}$$

4. Empirical Analysis Results

4.1. Data Sources. Selecting listed companies in Shenzhen Stock Exchange as empirical samples, this paper demonstrates the support degree of different levels of capital markets for the development of strategic emerging industries. The screening of listed companies in strategic emerging industries is based on two principles; that is, the industry in which the enterprise is located must belong to the subdivision of seven strategic emerging industries, and the first main business of the enterprise belongs to strategic emerging industries, and the corresponding main business income accounts for the largest proportion. In order to ensure the validity of the sample and consider the impact of nontradable shares reform, this paper selects 469 listed companies

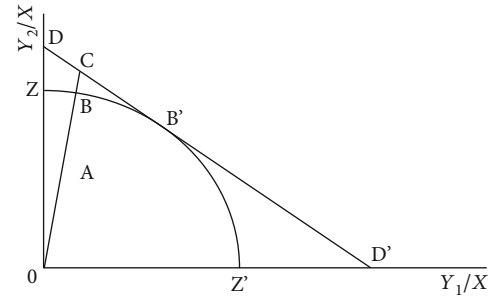


Figure 3: Output-oriented DEA technology and allocation efficiency.

in A-share strategic emerging industries after excluding ST shares as shown in Table 1.

4.2. Statistical Description of Samples

4.2.1. Descriptive Statistics of All Samples. The statistical description of financial support for input-output indicators of strategic emerging industries is shown in Table 2.

According to Table 2, the descriptive statistical results of input indicators show that the total amount of the two major financing methods for strategic emerging industries in China is large and fluctuates greatly. From the perspective of listed companies, the average value of total equity financing in the input index of financial support efficiency (FSE) is 1.025 billion yuan, and the standard deviation is 14.26. The average amount of debt financing is 2.451 billion yuan, and its standard deviation is as high as 63.58. It can be seen that, on the one hand, the total amount of equity financing and debt financing of listed companies in strategic emerging industries in China is relatively large, and debt financing is still the most important financing method. On the other hand, for listed companies in different strategic emerging industries, the total amount of the two major financing methods fluctuates greatly in different periods.

4.2.2. Sample Descriptive Statistics of Energy Conservation and Environmental Protection Industry (ECEPI)

(1) Main Board of ECEPI. According to Table 3, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of listed companies on the main board of ECEPI is 1.581 billion yuan, which is far less than the average value of total debt financing (4.077 billion yuan). It can be seen that debt financing is still the most important financing method of energy conservation and environmental protection industry. The average cost of equity financing (0.47) is less than the average cost of debt financing (3.20), which shows that the debt financing cost of listed companies on the main board of ECEPI is higher than that of equity financing. According to the statistical results of output indicators, the average return on net assets is 10.12%, the average turnover of main business increases by 10.94%, and the average turnover of balance sheet is 52.00%. The listed companies on the main board of ECEPI are year after year.

Table 1: Sample sources and statistics.

Strategic emerging areas	Number of households	Motherboard	Small- and medium-sized board of its own plate	Growth Enterprise Market
Energy conservation and environmental protection	74	13	34	27
High and new technology	71	15	32	24
Biology	58	25	24	9
High-end manufacturing	61	16	36	9
New energy	69	27	31	11
New material	67	26	29	12
New energy vehicle	69	12	41	16
Total	469	134	227	108

Table 2: Statistics of input-output indicators of the whole sample.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	10.25	137.07	0.39	14.26
	Cost of equity financing (%)	1.04	4.32	0.00	0.69
	Total amount of debt financing (100 million yuan)	24.51	849	0.07	63.58
	Debt financing cost (%)	1.23	35.02	-66.05	4.06
	Return on equity (%)	7.36	324.42	-159.97	13.23
Output indicators	Growth rate of main business income (%)	17.03	880.88	-97.77	41.48
	Turnover rate of total assets (%)	63.26	389.00	0.62	42.23

Table 3: Statistics of input-output index of main board of ECEPI.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	15.81	86.56	1.03	23.47
	Cost of equity financing (%)	0.47	0.97	0.00	0.28
	Total amount of debt financing (100 million yuan)	40.77	200.00	1.33	50.10
	Debt financing cost (%)	3.20	10.94	-0.43	2.30
	Return on equity (%)	10.12	29.1	-18.90	7.65
Output indicators	Growth rate of main business income (%)	10.94	71.23	-26.24	20.43
	Turnover rate of total assets (%)	52.00	154.00	10.38	32.94

(2) Small- and Medium-Sized Boards in Energy-Saving and Environmental Protection Industries. According to Table 4, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of small- and medium-sized listed companies in ECEPI is 889 million yuan, which is less than the average value of total debt financing (1.462 billion yuan), which shows that debt financing is still the most important financing method in energy conservation and environmental protection industry. The average cost of equity financing (1.26) is higher than that of debt financing (0.87), so we can know that the cost of equity financing of small- and medium-sized listed companies in ECEPI is higher than that of debt financing. According to the statistical results of output indicators, the average return on equity is 6.96%. The average growth rate of main business income reached 14.33%. The average turnover rate of total assets is 67.28%. This indicates that the overall operational ability, profitability, and growth ability of small- and medium-sized listed companies in energy conservation and environmental protection industries show signs of improving year by year. But the standard deviation statistical results show that the performance of small- and medium-sized listed companies in ECEPI is quite different in different periods, especially the standard deviation of the growth rate of main business income and the turnover rate of total assets is higher.

(3) Growth Enterprise Market of Energy Conservation and Environmental Protection Industry. According to Table 5, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of listed companies on GEM of ECEPI is 866

Table 4: Descriptive statistics of input-output index variables of small- and medium-sized boards in energy-saving and environmental protection industries from 2008 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	8.89	48.15	1.23	7.68
	Cost of equity financing (%)	1.26	2.23	0.03	0.65
	Total amount of debt financing (100 million yuan)	14.62	110.00	0.63	18.69
	Debt financing cost (%)	0.87	12.39	-5.26	2.32
	Return on equity (%)	6.96	38.05	-77.65	12.21
Output indicators	Growth rate of main business income (%)	14.33	145.77	-65.98	29.12
	Turnover rate of total assets (%)	67.28	176.29	15.07	31.90

Table 5: Descriptive statistics of input-output index variables of energy-saving and environmental protection industry GEM from 2010 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	8.66	86.24	2.25	9.11
	Cost of equity financing (%)	0.49	1.00	0.01	0.31
	Total amount of debt financing (100 million yuan)	5.42	40.90	0.34	7.27
	Debt financing cost (%)	-0.53	16.93	-8.19	3.78
	Return on equity (%)	8.08	29.28	-10.18	5.36
Output indicators	Growth rate of main business income (%)	28.21	170.33	-63.85	35.65
	Turnover rate of total assets (%)	44.70	83.95	9.79	16.61

million yuan, which is higher than the average value of total debt financing (542 million yuan). The average cost of equity financing (0.49) is greater than the average cost of debt financing (-0.53). It can be seen that the listed companies on the GEM of energy-saving and environmental protection industries have limited business scale, although they have innovative ability, but the banking institutions have small credit scale because of greater risks. According to the statistical results of output indicators, the average return on equity is 8.08%. The average growth rate of main business income reached 28.21%. The average turnover rate of total assets is 44.70%. This indicates that the overall operation ability, profitability, and growth ability of listed companies on the GEM of energy-saving and environmental protection industries are developing healthily, but the statistical results of standard deviation show that the performance of listed companies on the GEM of energy-saving and environmental protection industries is quite different in different periods, especially the standard deviation is higher.

4.2.3. Sample Descriptive Statistics of the New Generation Information Technology Industry (NGITI)

(1) The Main Board of NGITI. According to Table 6, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of listed companies on the main board of the NGITI is 1.396 billion yuan, far less than the average value of total debt financing (9.058 billion yuan), which shows that debt financing is still the most important financing method of the NGITI. The average cost of equity financing (0.46) is less than the average cost of debt financing (0.96), which shows that the debt financing cost of listed companies on the main board of the NGITI is slightly higher than the equity financing cost. According to the statistical results of output indicators, the average return on equity is 6.50%. The average growth rate of main business income reached 13.93%. The average turnover rate of total assets is 106.86%. This indicates that the overall operational ability, profitability, and growth ability of the listed companies on the main board of the NGITI show signs of improving year by year. However, the results of standard deviation statistics show that the performance of the main board listed companies in the NGITI is quite different in different periods, especially the standard deviation of the growth rate of main business income and the turnover rate of total assets is higher.

(2) Small- and Medium-Sized Boards in the NGITI. According to Table 7, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of small- and medium-sized listed companies in the NGITI is 678 million yuan, far less than the average value of total debt financing (1.184 billion yuan), which shows that debt financing is still the most important financing method in the NGITI. The average cost of equity financing (1.21) is higher than that of debt financing (0.17), which shows that the equity financing cost of small- and medium-sized listed companies in the NGITI is slightly higher than that of debt financing. According to the statistical results of output indicators, the average return on equity is 8.12%. The average growth rate of main business income reached 19.49%. The average turnover rate of total assets is

Table 6: Descriptive statistics of input-output index variables of the main board of the NGITI from 2008 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	13.96	96.70	1.31	16.54
	Cost of equity financing (%)	0.46	0.98	0.01	0.28
	Total amount of debt financing (100 million yuan)	90.58	849.00	1.07	188.10
	Debt financing cost (%)	0.96	12.82	-5.12	1.96
	Return on equity (%)	6.50	26.11	-36.30	7.13
Output indicators	Growth rate of main business income (%)	13.93	162.51	-75.89	28.45
	Turnover rate of total assets (%)	106.86	389.00	10.95	88.42

Table 7: Descriptive statistics of input-output index variables of small- and medium-sized boards in the NGITI from 2008 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	6.78	46.85	1.2	6.74
	Cost of equity financing (%)	1.21	2.32	0.03	0.61
	Total amount of debt financing (100 million yuan)	11.84	179.00	0.07	26.02
	Debt financing cost (%)	0.17	9.05	-6.73	2.25
	Return on equity (%)	8.12	26.82	-56.22	7.89
Output indicators	Growth rate of main business income (%)	19.49	145.85	-48.47	30.76
	Turnover rate of total assets (%)	61.31	263.87	17.13	34.28

61.31%. This indicates that the overall operational ability, profitability, and growth ability of listed companies in strategic emerging industries show signs of improving year by year, but the statistical results of standard deviation show that the performance of listed companies in strategic emerging industries is quite different in different periods, especially the standard deviation of the growth rate of main business income and the turnover rate of total assets is higher.

(3) NGITI GEM. According to Table 8, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of GEM listed companies in the NGITI is 883 million yuan, which is higher than the average value of total debt financing (333 million yuan). The average cost of equity financing (0.45) is greater than the average cost of debt financing (-2.45). It can be seen that the NGITI GEM listed companies have limited business scale, although they have innovative ability, but the banking institutions have small credit scale because of greater risks. According to the statistical results of output indicators, the average return on equity is 7.40%. The average growth rate of main business income reached 27.83%. The average turnover rate of total assets is 43.29%. This indicates that the overall operational ability, profitability, and growth ability of the NGITI of GEM listed companies have shown benign development. However, the results of standard deviation statistics show that the performance of GEM listed companies in the NGITI is quite different in different periods, especially the standard deviation of the growth rate of main business income and the turnover rate of total assets is higher.

4.2.4. Sample Descriptive Statistics of Bioindustry

(1) Main Board of Bioindustry. According to Table 9, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of listed companies on the main board of bioindustry is 744 million yuan, far less than the average value of total debt financing (1.648 billion yuan), which shows that debt financing is still the most important financing method of bioindustry. The average cost of equity financing (1.35) is less than the average cost of debt financing (1.66), which shows that the debt financing cost of listed companies on the main board of bioindustry is slightly higher than that of equity financing. According to the statistical results of output indicators, the average return on equity is 8.48%. The average growth rate of main business income is 11.42%, and the average turnover rate of total assets is 80.90%, which indicates that the overall operation ability, profitability, and growth ability of listed companies on the main board of bioindustry show signs of improving year by year, but the statistical results of standard deviation show that the performance of listed companies on the main board of bioindustry is quite different in different periods.

(2) Small- and Medium-Sized Boards in Bioindustry. According to Table 10, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of small- and medium-sized listed companies in bioindustry is 779 million yuan, slightly higher than the average value of total debt financing (677 million yuan). The average cost of equity financing (1.17) is less than the average cost of debt financing (1.41), which

Table 8: Descriptive statistics of input-output index variables of the NGITI GEM from 2010 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	8.83	24.91	1.78	6.08
	Cost of equity financing (%)	0.45	1.00	0.00	0.31
	Total amount of debt financing (100 million yuan)	3.33	55.10	0.15	6.06
	Debt financing cost (%)	-2.45	9.48	-16.41	4.65
	Return on equity (%)	7.40	30.43	-17.72	6.81
Output indicators	Growth rate of main business income (%)	27.83	188.79	-53.22	38.31
	Turnover rate of total assets (%)	43.29	100.78	13.81	21.61

Table 9: Descriptive statistics of input-output index variables of bioindustry main board.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	7.44	29.64	0.48	5.74
	Cost of equity financing (%)	1.35	2.49	0.04	0.69
	Total amount of debt financing (100 million yuan)	16.48	106.00	0.40	18.80
	Debt financing cost (%)	1.66	9.48	-1.91	1.90
	Return on equity (%)	8.48	40.06	-36.00	10.76
Output indicators	Growth rate of main business income (%)	11.42	66.10	-37.83	18.41
	Turnover rate of total assets (%)	80.90	318.99	7.26	51.41

Table 10: Descriptive statistics of input-output index variables of small- and medium-sized boards in bioindustry from 2008 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	7.79	75.12	1.06	10.78
	Cost of equity financing (%)	1.17	2.28	0.02	0.63
	Total amount of debt financing (100 million yuan)	6.77	79.00	0.12	9.82
	Debt financing cost (%)	1.41	28.80	-14.96	4.60
	Return on equity (%)	13,43	95.41	-67.69	15.10
Output indicators	Growth rate of main business income (%)	25.67	507.65	-54.88	51.51
	Turnover rate of total assets (%)	66.27	355.04	12.90	57.29

shows that the debt financing cost of small- and medium-sized listed companies in bioindustry is slightly higher than the equity financing cost. According to the statistical results of output indicators, the average return on equity is 13.43%. The average growth rate of main business income is 25.67%, and the average turnover rate of total assets is 66.27%, which indicates that the overall operation ability, profitability, and growth ability of small- and medium-sized listed companies in bioindustry show signs of improving year by year, but the statistical results of standard deviation show that the performance of small- and medium-sized listed companies in bioindustry is quite different in different periods.

(3) Bioindustry GEM. According to Table 11, from the descriptive statistical results of input indicators, the average value of total equity financing in the input indicators of FSE of listed companies on the GEM of bioindustry is 934 million yuan, which is higher than the average value of total debt financing (399 million yuan). The average cost of equity financing (0.44) is greater than the average cost of debt financing (-0.42). It can be seen that the listed companies on the GEM of bioindustry have limited business scale, although they have innovative ability, but the credit scale of banking institutions is small because of greater risks. According to the statistical results of output indicators, the average return on equity is 9.71%. The average growth rate of main business income reached 25.58%. The average turnover rate of total assets is 43.99%. This indicates that the overall operation ability, profitability, and growth ability of listed companies on the GEM of bioindustry show benign development, but the statistical results of standard deviation show that the performance of listed companies on the GEM of bioindustry is quite different in different periods, especially the standard deviation of the growth rate of main business income and the turnover rate of total assets is higher.

Table 11: Descriptive statistics of input-output index variables of bioindustry GEM from 2010 to 2015.

Input-output index		Average	Max value	Min value	S. D.
Input index	Total equity financing (100 million yuan)	9.34	36.57	2.72	7.00
	Cost of equity financing (%)	0.44	1.00	0.02	0.29
	Total amount of debt financing (100 million yuan)	3.99	32.00	0.07	6.15
	Debt financing cost (%)	-0.42	21.42	-8.50	4.25
	Return on equity (%)	9.71	22.17	-33.62	8.31
Output indicators	Growth rate of main business income (%)	25.58	118.81	-16.03	22.62
	Turnover rate of total assets (%)	43.99	108.83	11.02	18.79

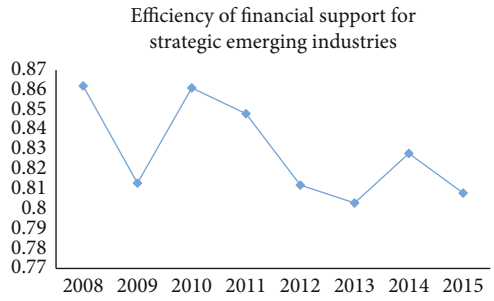


Figure 4: Efficiency chart of financial support for strategic emerging industries.

Table 12: Distribution of strategic emerging industries in different regions.

Strategic emerging industries	Eastern region	Central region	Western region
Listed company	335	78	56
Proportion	71%	17%	12%

4.3. Data Preprocessing. "Normalization" pretreatment method is as follows:

$$y_{ij} = 0.1 + 0.9 \times \frac{x_{ij} - m_j}{M_j - m_j}. \quad (29)$$

Among them, $m_j = \min_i(x_{ij})$; $M_j = \max_i(x_{ij})$

$$i = 1, 2, 3, \cdots, n\,; y_{ij} = [0, 1]. \quad (30)$$

4.4. Analysis of FSE

4.4.1. Changes in the Efficiency of Financial Support under Time Characteristics. Using the data of input-output variables of listed companies in strategic emerging industries, the FSE of 469 listed companies in strategic emerging industries from 2008 to 2015 is calculated, as shown in Figure 4.

From Figure 4, it can be concluded that the FSE of strategic emerging industries fluctuated between 0.8 and 0.9 from 2008 to 2015, showing a trend of "narrow range fluctuation." Specifically, the efficiency of financial support declined from 2008 to 2009, while the efficiency of financial

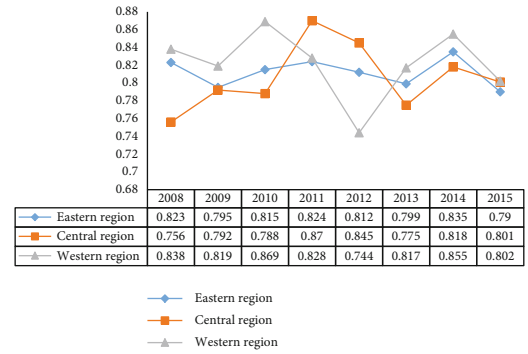


Figure 5: Comparison of FSE in different regions.

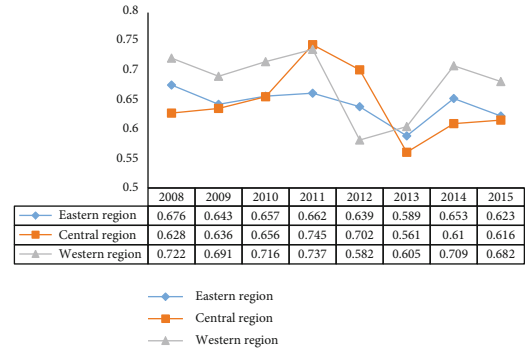


Figure 6: Comparison of equity financing efficiency in different regions.

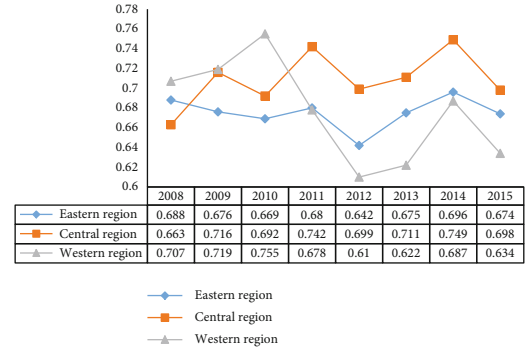


Figure 7: Comparison of debt financing efficiency in different regions.

Table 13: Equity financing efficiency and debt financing efficiency.

Strategic emerging industries		2008	2009	2010	2011	2012	2013	2014	2015	Mean value
Efficiency of equity financing	Energy saving	0.85	0.77	0.67	0.64	0.72	0.62	0.72	0.68	0.85
	Information	0.74	0.59	0.68	0.69	0.67	0.50	0.66	0.64	0.74
	Biology	0.63	0.58	0.70	0.70	0.62	0.61	0.67	0.69	0.63
	Manufacture	0.80	0.78	0.78	0.82	0.49	0.67	0.73	0.69	0.80
	Energy	0.64	0.62	0.80	0.74	0.67	0.72	0.66	0.68	0.64
	Materials	0.76	0.57	0.78	0.81	0.69	0.58	0.61	0.63	0.76
	Automobile	0.72	0.79	0.63	0.61	0.60	0.46	0.54	0.46	0.72
	Mean value	0.74	0.67	0.72	0.71	0.64	0.59	0.65	0.64	0.74
Efficiency of debt financing	Energy saving	0.83	0.73	0.65	0.66	0.68	0.72	0.68	0.70	0.71
	Information	0.85	0.81	0.81	0.78	0.69	0.72	0.81	0.75	0.78
	Biology	0.58	0.61	0.64	0.69	0.71	0.74	0.70	0.70	0.67
	Manufacture	0.86	0.70	0.77	0.75	0.69	0.72	0.73	0.73	0.74
	Energy	0.62	0.68	0.83	0.68	0.58	0.00	0.00	0.60	0.50
	Materials	0.71	0.64	0.75	0.67	0.59	0.00	0.00	0.65	0.50
	Automobile	0.79	0.72	0.73	0.68	0.62	0.63	0.70	0.66	0.69
	Mean value	0.75	0.70	0.74	0.70	0.65	0.50	0.52	0.68	0.66

support increased from 2009 to 2010, and the efficiency of financial support showed a downward trend from 2011 to 2013. The main reason is that the financial crisis that began to break out at the end of 2008 has had a great vicious impact on the operation management and profit level of strategic emerging industries.

4.4.2. Changes in the Efficiency of Financial Support under Spatial Characteristics

(1) Distribution of Listed Companies in Strategic Emerging Industries in Different Regions. The distribution of strategic emerging industries in eastern, central, and western China from 2008 to 2015 is shown in Table 12.

In Table 12, the distribution is strong in the east and weak in the west. The number of listed companies in the eastern region ranks first with 335 (accounting for 71%), while the number of listed companies in the western region is the least, with only 56 (accounting for 12%). The superior listing financing environment in the eastern region has absorbed more strategic emerging industry enterprises, which shows that the listing financing environment is one of the important conditions affecting enterprises to settle down.

(2) Comparison of FSE in Different Regions. By dividing the listed companies in strategic emerging industries into regions through FSE, we can get the trend chart of FSE in different regions from 2008 to 2015, as shown in Figure 5.

In Figure 5, the overall efficiency of financial support in the eastern region from 2008 to 2015 is relatively balanced, with a slight fluctuation between 0.79 and 0.83. However, the efficiency fluctuation amplitude in the central and western regions is larger. From the average value, the average efficiency of financial support from 2008 to 2015 is the highest in the western region (0.822), followed by the eastern region (0.810); the lowest is in the central region (0.806).

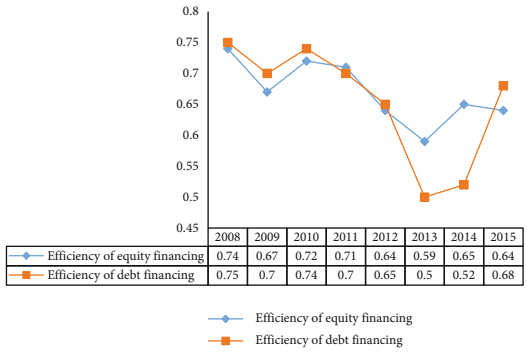
(3) Comparison of Equity Financing Efficiency in Different Regions. In Figure 6, the change trend of equity financing efficiency in the eastern, central, and western regions from 2008 to 2015 is generally consistent. From the average value, it can be concluded that the average efficiency of equity financing from 2008 to 2015 is the highest in the western region (0.681), followed by the central region (0.644); the eastern region has the lowest (0.643). The efficiency of equity financing is generally low.

(4) Comparison of Debt Financing Efficiency in Different Regions. It can be seen from Figure 7 that the average efficiency of debt financing from 2008 to 2015 is the highest in the central region (0.709), followed by the western region (0.682) and the lowest in the eastern region (0.675).

4.5. Measurement and Comparative Analysis of the Effectiveness of Financial Assistance

4.5.1. Results of Measures of Equity Financing Efficiency and Debt Financing Efficiency. As mentioned above, this paper takes the total investment and cost of equity financing as the input index to measure the effectiveness of equity financing and takes the total investment and cost of debt financing as the input index to measure the efficiency. The equity financing efficiency and debt financing efficiency of listed companies from 2008 to 2015 are calculated as shown in Table 13.

Observing Table 13, it can be concluded that from 2008 to 2015, the equity financing efficiency and debt financing efficiency of energy conservation and environmental protection, high-end equipment manufacturing, and



	2008	2009	2010	2011	2012	2013	2014	2015
Efficiency of equity financing	0.74	0.67	0.72	0.71	0.64	0.59	0.65	0.64
Efficiency of debt financing	0.75	0.7	0.74	0.7	0.65	0.5	0.52	0.68

Figure 8: Comparison of two financing efficiencies.

new generation information technology industries are higher than those of other industries.

4.5.2. Comparative Analysis of Two Financing Efficiencies of Strategic Emerging Industries. In Figure 8, on the one hand, the change trend of equity financing efficiency and debt financing efficiency of listed companies in strategic emerging industries from 2008 to 2015 is basically the same. On the other hand, equity financing efficiency value and debt financing efficiency value are in the range of 0.5-0.75, and the overall efficiency value is not high. It can be seen that the changing trend of equity financing efficiency, debt financing efficiency, and FSE tends to be consistent. The outbreak of the financial crisis in 2008-2009 led to a decline in efficiency, and the loose fiscal policy of the 4 trillion investment plan in the later period stimulated the efficiency of equity financing and debt financing. But after 2010, the 4 trillion investment plan has stopped.

To improve the efficiency of financial support for strategic emerging industries, it is necessary to systematically advance from multiple angles and in all directions. Specifically, the first is to clarify the boundary between government and market support and improve the financial support system. The second is to optimize the policy financial support environment and narrow the regional development differences. The third is to improve the multilevel capital market system and improve the efficiency of equity financing. The fourth is to encourage innovation in credit and bond business and improve the efficiency of debt financing. Fifth is to promote the opening of capital projects, use foreign capital to drive, improve the efficiency of capital support, and so on.

5. Conclusion

Actively introduce foreign advanced technology and pay attention to research and development investment. There are some problems in the resource allocation effect of China's emerging industries, and there is still room for optimization, and the low pure technical efficiency is the main reason for the low comprehensive efficiency. Therefore, we should start with pure technical efficiency, by actively introducing foreign advanced technology, increasing investment in the company's technology research and development department, and introducing a group of high-quality technicians, so as to improve pure technical efficiency.

Build a platform for enterprise learning and communication. Companies in Beijing, Shanghai, and Guangzhou are generally more efficient. Therefore, enterprises in western provinces should have more exchanges and studies with enterprises in Beijing, Shanghai, and Guangzhou. The government should build a national enterprise learning and exchange platform. Through the effect of knowledge transfer and learning effect, we can improve our comprehensive ability.

Improve the financial development environment and cultivate a healthy financial ecology. The time of company establishment, the location of company, and the form of company ownership have a significant impact on the technical efficiency of China's emerging industries, which shows that there are problems in China's financial environment. Therefore, it is necessary to improve the construction of social credit system, actively create a virtuous circle of financial environment, so that enterprises can equally distribute financial resources.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

Acknowledgments

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