Analysis on Financial Support Efficiency of Strategic Emerging Industries Based on DEA—Tobit Model

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Abstract. Cultivating and developing strategic emerging industries is very important for promoting the rapid transformation of economic development mode, and adjusting and optimizing the economic structure. Financial support plays the role of guidance and support in the development process of strategic emerging industries. Based on the measurement results for financial support of strategic emerging industries in Guangdong, the paper constructs Tobit model analyzing factors which influence efficiency. The empirical results indicate that the reason why the average value of comprehensive efficiency of financial support for strategic emerging industries in Guangdong is lower scale efficiency. Financial subsidy, tax preference and government procurement is good for improving the efficiency of financial support, and financial subsidy has the most evident effect. Therefore, we should use the means of marketization operation to improve the availability efficiency of financial fund, realize recycle of financial funds, and takes different financial support measures in different development stages of strategic emerging industries.

Introduction
In order to accelerate the transformation of economic development pattern and adjust and optimize the economic structure, on September 8th 2010, the State Council considered and launched Decision of State Council for Cultivating and Developing Strategic Emerging Industries, determined to cultivate and develop the industries including environmental protection, new generation information technology, biology, high-end equipment manufacturing, new energy, new materials and alternative fuel vehicles, and proposed improving the support system of finance and tax policies, guiding and encouraging the social funds to invest strategic emerging industries. In order to accelerate cultivating and developing strategic emerging industries, the local governments introduce policies and guiding ideas about supporting the development of strategic emerging industries. The paper mainly analyzes the principles and paths of financial support for the development of strategic emerging industries, analyzes the means of financial support for the development of strategic emerging industries from the aspect of financial tax policy, and analyzes the effect of financial support for the development of strategic emerging industries. And the financial support efficiency and influencing factors of strategic emerging industries were analyzed for making a breakthrough in the research field.

Model, Measurement Index and Data Specification
Based on the above analysis, the paper uses data envelopment analysis (DEA) and Tobit model, DEA——Tobit method, to analyze the financial support efficiency and influencing factors of strategic emerging industries. Through the data achieved in investigation, the paper firstly uses DEA method to measure the support efficiency of financial investment on strategic emerging industries, and makes comparative analysis on the difference of financial support efficiency between different strategic emerging industries. Secondly, the paper uses the measurement results of DEA efficiency as the dependent variable of Tobit model to analyze the factors influencing financial support efficiency of strategic emerging industries.
2.1 DEA model and measurement index

1. Selection of DEA model

DEA (Data Envelopment Analysis) is a nonlinear evaluation method which was firstly proposed by Farrel in 1957, and was developed as the concept of relative efficiency by A. Charnes, W.W. Cooper and E. Rhode in 1978. It is used to evaluate the relative efficiency and benefit of the same type of multi-input and multi-output decision-making units (DMU). DEA model can be divided into input-oriented type and output-oriented type. Input-oriented type is the linear programming problem making the investment minimal under the situation that the output is fixed. Output-oriented type is the linear programming problem making output maximal under the situation that the investment is fixed. The importance of researching financial support efficiency of strategic emerging industries is how to promote the increase of output value and scale efficiency of strategic emerging industries with the lowest financial investment. Therefore, the paper uses input-oriented DEA model to evaluate the financial support efficiency of strategic emerging industries, which has unique advantages.

2. Selection of decision-making unit, input and output indicators

DEA method can evaluate the relative effectiveness of compared objects. In order to correctly use DEA method and achieve scientific evaluation conclusions and useful decision information, we must correctly select decision-making unit. Based on following the above conditions, the paper selects 155 strategic emerging industry enterprises including new electrical information, new energy automobiles, LED, biology, high-end equipment manufacture, energy conservation and environment protection, new energy and new materials as decision-making unit, and most of the enterprises are key and cultivating strategic emerging enterprises, which are representative.

The indicators of evaluating financial support efficiency of strategic emerging industry development are constructed. Firstly, the selected input and output indicators should reflect evaluation objective and evaluation content. Secondly, the strong linear relationship between input and output indicators should be avoided technically. Lastly, the diversity and achievability of indicators should be considered. The paper uses factor analysis method to evaluate the financial support efficiency of strategic emerging industries, which means to analyze key factors influencing input (financial investment) and output (net profit of enterprises) to measure the input and output efficiency. According to the selection principles of variables including critical, scientific, operable and achievable, the paper selects government financing and the proportion of government procurement to sales of enterprises as input indicators, and uses the total asset and net profit of enterprises as output indicators.

(2) Tobit model and measurement indicators

1. Selection of Tobit model

The comprehensive efficiency of financial supporting strategic emerging industries which is measured by DEA method not only is influenced by the selected input and output indicators, but also is influenced by environmental factors. Therefore, the measurement results of DEA method should be analyzed comprehensively, which needs to use Tobit model to analyze the factors influencing financial support efficiency.

The comprehensive efficiency of financial supporting strategic emerging industries which is measured by DEA method is between 0 and 1. The data has the characteristic of truncation. If the general least square method is directly used for regression analysis, the parameter estimation is not consistent. In order to make up the limitation, Tobit proposed Tobit model in 1958. Therefore, the paper uses DEA——Tobit method to make empirical analysis on factors influencing financial support efficiency which is measured by DEA method. And the paper makes analysis on financial support efficiency of strategic emerging industries.

2. Selection of measurement indicators

As one of the important policy tools of finance supporting the development of strategic emerging industries, financial subsidy is a prior incentive method. The paper selects it as one of explanatory variables to analyze the efficiency contribution and function degree of it for financial support. Tax preference is the important tool of finance supporting the development of strategic emerging...
industries. But it is an afterward incentive method. The contribution and function degree of it for financial support is different from financial subsidy. Government procurement is the afterward incentive policy tool of financial support. It has effective incentive function on strategic emerging industries. The paper selects it as the explanatory variable to make comparative analysis between it and other policy tools.

(3) Data specification

The data in the paper is from the questionnaire survey of finance supporting strategic industries in Guangdong. The range includes the enterprises in Guangzhou, Shenzhen, Foshan, Dongguan, Zhuhai, Zhongshan, Jiangmen, Huizhou, Zhaoqing, Heyuan, Meizhou, Chaozhou and Shaantou, and most of investigated enterprises are key and cultivating strategic emerging enterprises in Guangdong. The enterprises are strategic emerging enterprises including high-end new electrical information, new-energy automobiles, LED, biology, high-end equipment manufacture, energy conservation and environment protection, new energy and new materials, which are representative.

The questionnaire survey recycles 155 effective questionnaires. The investigation includes government financing enterprises, government procurement, management condition of enterprises and requirements of financial support, and the investigation contains the data support required by the research.

Empirical Analysis

(1) DEA analysis on financial support efficiency of strategic emerging industries

The purpose of finance supporting development of strategic industries is to realize maximization of industry value by inputting financial support funds. According to the setting for decision-making unit and input/output indicators in the above chapter, the paper uses DEAP2.1 software, and selects CRS model and uses input orientation to measure the comprehensive efficiency, pure technical efficiency and scale efficiency, as shown in Table 1.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Comprehensive efficiency</th>
<th>Pure technical efficiency</th>
<th>Scale efficiency</th>
<th>Returns to scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>New energy</td>
<td>0.538</td>
<td>1.000</td>
<td>0.538</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>Biological medicine</td>
<td>0.408</td>
<td>0.941</td>
<td>0.448</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>New material</td>
<td>0.258</td>
<td>0.963</td>
<td>0.261</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>Energy conservation and environment</td>
<td>0.404</td>
<td>0.994</td>
<td>0.408</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-end electronic information</td>
<td>0.388</td>
<td>0.970</td>
<td>0.401</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>High-end equipment manufacture</td>
<td>0.503</td>
<td>1.000</td>
<td>0.503</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>New-energy automobiles</td>
<td>0.474</td>
<td>0.917</td>
<td>0.476</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>LED</td>
<td>0.283</td>
<td>0.818</td>
<td>0.399</td>
<td>Progressive increase</td>
</tr>
<tr>
<td>Mean</td>
<td>0.407</td>
<td>0.950</td>
<td>0.429</td>
<td></td>
</tr>
</tbody>
</table>

For measuring financial support efficiency of strategic emerging industries, comprehensive efficiency = pure technical efficiency × scale efficiency. Comprehensive efficiency reflects the effective utilization of financial fund, and pure technical efficiency mainly measures the operation efficiency and management level of financial payment system. And scale efficiency measures if input of financial funds is the best scale. As shown in Table 1, the comprehensive financial support
efficiency of strategic emerging enterprises is 0.407, which indicates that the resource allocation of financial funds doesn’t reach the optimal state, and the financial funds are not fully used. The pure technical efficiency and scale efficiency is 0.950 and 0.429, and doesn’t reach the optimal state, which indicates that the operation efficiency and management level of finance supporting strategic emerging industries in Guangdong needs to be improved. And the investment scale of financial funds is out of keeping with the requirements for the development of strategic emerging industries.

Firstly, for comprehensive efficiency, the financial support efficiency of eight strategic emerging enterprises in Guangdong is 0.538, 0.408, 0.258, 0.404, 0.388, 0.503, 0.474 and 0.283, which doesn’t achieve DEA efficiency. The financial support efficiency of new material and LED industry is the lowest, 0.258 and 0.283, which relates to low scale efficiency. The industries are in the progressive increase stage of returns to scale, the financial support should be strengthened to attract the input of social funds to support the development of the industries. New energy and high-end equipment manufacturing industry has the highest financial support efficiency, 0.538 and 0.503. The pure technical efficiency of the industries is 1, which achieves DEA efficiency. But the scale efficiency is only 0.538 and 0.503. So the financial investment should be strengthened to improve the financial support efficiency.

Secondly, for pure technical efficiency, the pure technical efficiency of new energy and high-end equipment manufacturing industry is 1, which achieves DEA efficiency, and the pure technical efficiency of other industries is less than 1, which doesn’t achieve DEA efficiency.

Lastly, for scale efficiency, the scale efficiency of eight strategic emerging industries in Guangdong is low, and the average value is only 0.429, which indicates that under the condition that financial finds keeps input proportion and output level not change, if each industry can achieve the best production scale, 57.1% of investment can be reduced averagely, which is the main reason causing low comprehensive efficiency of financial support. From Table 1, we can see that the scale efficiency of strategic emerging industries in Guangdong is in the progressive increase stage of returns to scale, so low scale efficiency is caused by insufficient finance investment.

(2)Analysis on factors influencing financial support efficiency of strategic emerging industries—based on Tobit model

There are many factors influencing financial support efficiency of strategic emerging industries such as expenditure structure of finance, management level and execution of policy, operation management and profitability of enterprises. In order to analyze the factors influencing financial support efficiency of strategic emerging industries, the paper selects the common policy tools of finance supporting development of strategic emerging industries including financial subsidy, tax preference and government procurement as explanatory variables, and uses the turnover of enterprises as the control variable to make Tobit regression analysis on financial support efficiency.

D1 represents financial subsidy. When the enterprises get finance subsidy, D1=1, or D1=0.
D2 represents tax preference. When the enterprises get tax preference, D2=1, or D2=0.
D3 represents government procurement. When the enterprises achieve government procurement, D3=1, or D3=0.

The turnover of enterprises for finance supporting strategic emerging industries aims at promoting the development, which makes output value maximal. In order to analyze the influence of three policy tools on financial support efficiency, the paper selects the turnover of enterprises as control variable to avoid the influence of enterprise performance on financial support efficiency.

According to the above analysis, the comprehensive financial support efficiency of 155 enterprises which is measured by DEA method is used as the explanatory variable (Y). And finance subsidy (D1), tax preference (D2) and government procurement (D3) are used as explanatory variables. The turnover of enterprise is used as the control variable (X). The data is from the questionnaire for 155 enterprises with financial supporting strategic emerging industries in Guangdong. Tobit model is established, and Eviews6.0 software is used for regression analysis. And the results are as follows.
Table 2 Tobit regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Z-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.22</td>
<td>3.67</td>
<td>0.0002</td>
</tr>
<tr>
<td>X</td>
<td>1.33E-07</td>
<td>4.23</td>
<td>0.0000</td>
</tr>
<tr>
<td>D1</td>
<td>0.15</td>
<td>2.68</td>
<td>0.0072</td>
</tr>
<tr>
<td>D2</td>
<td>0.02</td>
<td>0.25</td>
<td>0.8049</td>
</tr>
<tr>
<td>D3</td>
<td>0.07</td>
<td>1.08</td>
<td>0.2780</td>
</tr>
</tbody>
</table>

Log likelihood: -32.17
Akaike info criterion: 0.533
Schwarz criterion: 0.658

From the regression results, we can see that log likelihood, AIC criterion and SC criterion indicates that the given model is more accurate. Explanatory variable D2 and D3 doesn’t pass evidence test, but the coefficient signal conforms to the expected result.

Firstly, from the coefficients of dummy variables, we can see that financial subsidy, tax preference and government procurement helps to improve the financial support efficiency, and the effect of finance subsidy the most evident. Averagely, increasing finance subsidy can make financial support efficiency increase by 0.15. But increasing tax preference or government procurement only makes financial support efficiency increase by 0.02 or 0.07, which indicates that finance subsidy is the most direct and the most effective policy tool supporting the development of strategic emerging industries.

Secondly, the coefficients of tax preference and government procurement don’t pass evidence test, so the policy tools have no great influence on improving financial support efficiency, which relates to the investigated enterprises. The most of the investigated enterprises are in start-up stage, and don’t achieve the requirements of government procurement, so many enterprises are prohibitive, which is the main reason making the influence of tax preference and government procurement on improving financial support efficiency not evident.

Conclusion and Suggestions

(1) Conclusion

Firstly, DEA measurement results of financial support efficiency of strategic emerging enterprises in Guangdong indicate that the average value of pure technical efficiency of finance supporting strategic enterprises is in the high level, but the mean of scale efficiency is very low, which is the main reason which makes comprehensive efficiency of financial support low. And the scale efficiency of financial support for strategic emerging industries in Guangdong is the progressive increase stage, so low scale efficiency is mainly caused by insufficient financial investment. Therefore, under the condition of obeying the principle of competition and selection, and equity and inclusiveness, the investment of financial funds should be enhanced, and the guiding role of financial funds should be played, and the input of social funds should be guided to meet the fund demand of strategic emerging industries in different development stages.

Secondly, Tobit analysis on factors influencing financial support efficiency of strategic emerging industries indicates that financial subsidies, tax preference and government procurement helps to improve the financial support efficiency. But financial subsidy has the most evident effect. Therefore, the producer and consumer of strategic emerging industries can receive subsidy by price subsidy, purchase subsidy, interest subsidy and substituting subsidies with rewards, which directly stimulating the innovation and consumption of strategic emerging industries. Meanwhile, financial discount, financial guarantee and converting financial funds into trust investment or credit loans can be used to realize financialization of financial funds. The means of marketable operation is used to improve the utilization efficiency of financial funds and realize recycle of financial funds, which provides financial support for the development of strategic emerging industries.

Lastly, strategic emerging industry not only is the industrial development trend, but also is the leading industry and pillar industry in the future, so the fiscal means should be optimized and
supported to improve the financial support efficiency. During the start-up period of strategic emerging industries, financial support gives priority to fiscal subsidy and tax preference, which makes the scale of industries expand. During the growth period of strategic emerging industry, tax preference and government procurement should be used to cultivate consuming subject supporting industrial development. Therefore, for different development stages of strategic emerging industries, the government should use different financial support means to realize optimization of financial support efficiency.

(2) Policy suggestions
Firstly, for financial subsidy, the financial funds should be invested to strategic emerging industries. The social capital should be introduced into strategic emerging industries by the way of direct investment, financial subsidy, discount loans and loan guarantee, which not only provides sufficient funds and financing channels for the development of strategic emerging industries, but also eliminates the indetermination, spillover and resource barriers of strategic emerging industries. Secondly, reserve fund system can be introduced into tax preference policy for strategic emerging enterprises, which allows enterprises setting various reserve funds for technical development and innovation. And it allows deducting reserve funds of technical development. Thirdly, for government procurement, the proportion of government procurement to finance supporting strategic emerging enterprises should be increased, and the fund scale of government procurement should be expanded, which makes the government procurement become the major financial support tool. While the number of procured products for strategic emerging industries is increased, the procurement policy should be transferred to the front end of smiling curve, the procurement on technical innovation and development should be increased, and the guidance and support of government procurement on innovation should be emphasized.

Reference